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Vegetation of mowed and trampled habitats of a rural hilly area (Marche Region - central Italy)

A. Lancioni & F. Taffetani

Dipartimento di Scienze Agrarie, Alimentari e Ambientali, Università Politecnica delle Marche, Via Brecce Bianche 60131 Ancona, Italy.

Abstract

We present a phytosociological analysis of mowed and trampled habitats of a rural hilly area in the provinces of Ancona and Macerata, in the Marche Region (central Italy). The study revealed five coenoses: *Ranunculetum neapolitano-velutini* and *Lolio perennis-Plantaginetum majoris* belonging to the class *Molinio-Arrhenatheretea*; *Medicago hispidae-Vulpietum ligusticae* of the class *Stellarietea mediae*; *Poetum annuae* and *Coronopodo procumbentis-Sclerochloetum durae* of the class *Polygono-Poetea*. The first and the third of these six coenoses are proposed as new associations. Three new subassociations, five variants and a facies were also identified. We have interpreted the ecological significance of each of these coenoses through the application of a floristic-vegetational indices system. This method is specifically designed for application to rural contexts. The vegetation communities characterised by the highest evolution level (according to the Index of Maturity, IM) are those also characterised by the highest floristic richness (according to the Index of Floristic Biodiversity, IFB). These coenoses are managed by periodic mowing (class *Molinio-Arrhenatheretea*). The less mature and botanically poorest vegetation communities are those that have been disturbed more by trampling and soil compaction (class *Polygono-Poetea*). Finally, we have rebuilt the spatial succession of the vegetation communities detectable on the dirt roads, and we have illustrated the relationships between the land use, morphology and ecology of these phytocoenoses.

Keywords: Agroecosystem, vegetation, bioindicators, maturity, biodiversity, management, mowing, trampling.

Introduction

The management and conservation of marginal habitats in contact with cultivated fields are very important aspects in view of the need for the protection of agrobiodiversity (Altieri, 1999; Le Coeur *et al*., 2002; Marshall & Moonen, 2002; Musters *et al*., 2009). In the mosaic of habitats that can be observed in a rural landscape, boundaries and ecological differences among coenoses are sharper than generally occurs in contexts that are characterised by more natural environments (Forman & Godron, 1981). The seminatural elements that are detectable in these agroecosystems act as functional structures for the exchange of genetic material and for the dispersal of living organisms (Wassmuth *et al.,* 2009).

Today the complexity of these agroecosystems is increasingly threatened by overuse of the soil and by intensive farming techniques (De Snoo & Van der Poll, 1999; Bassler & Klotz, 2006). This complexity must be preserved, because these agroecosystems represent the connections with the natural areas of greater environmental value, such as those designated as Sites of Community Importance and hence protected as part of the Natura 2000 and Pan-European Ecological Network (Biondi *et al*., 2012).

Agricultural and environmental policies thus need to have as their first objectives the protection and restoration of conditions that will ensure the maintenance of a satisfactory level of biodiversity in areas that are mainly cultivated (Taffetani & Santolini, 1997; Van Elsen, 2000; Petersen *et al*. 2006; Biondi & Morbidoni, 2010). The European Union is pursuing this goal through the implementation of the Habitat Directive (92/43/EEC Dir.), the measures provided by the second Axis of the Rural Development Programmes (EC 1698/05 Reg.), the cross-compliance rules (EC 1782/03 Reg.), to which payments for individual farmers are tied, and through the definition of the High Nature Value Farmland Areas (EC 1257/99 Reg.), within the territory of each Member State (Baldock *et al*. 1993, 1995).

The overall objective of the present study was the investigation of the mowed and trampled phytocoenoses of a rural hilly area located in the central part of the Marche Region, in the territories comprised among the Provinces of Ancona and Macerata (central Italy). The study area is geologically characterised by clay-arenaceous and marly-calcareus rock. From the climatic point of view, the territory is part of the Submediterranean variant of the temperate-oceanic macrobioclimate (Rivas Martínez *et al*. 2004, Casavecchia *et al*. 2007). Edaphoxerophilous,

Corresponding author: Andrea Lancioni. *Department of Nutritional, Environmental and Agricultural Sciences, Polytechnic University of Marche, Via Brecce Bianche, 60131, Ancona, Italy; email: a.lancioni@univpm.it*

climatophilous and edaphohygrophilous series have been detected on both of these geological substrates (Biondi & Allegrezza, 1996a; Taffetani, 2000; Taffetani *et al*., 2003; Biondi & Allegrezza, 2004; Taffetani *et al*., 2004; Biondi, 2008; Taffetani & Rismondo, 2009; Taffetani & Orlandini, 2009; Biondi *et al*., 2010; Galdenzi *et al*., 2011).

The study area is intensively cultivated, and as a consequence it is impoverished in semi-natural habitats, such as woods, hedgerows, grassy verges and other meadow areas, and ditch vegetation. Even other structures that were once commonplace are now increasingly rare, such as dirt roads for the connection of the cultivated fields, and other unproductive areas, such as the turning areas at the heads of the fields. These areas have been largely removed to provide more arable land and to make mechanisation of the system more efficient.

Some authors have already investigated the ruderal vegetation of this area. They detected the therophytic communities of the road verges dominated by *Bromus diandrus* or *Sinapis alba*, the subnitrophylous vegetation of the road verges with prevalence of *Smyrnium olusatrum*, and the vegetation of the old-fields, belonging to the alliance *Inulo-Agropyrion* (Allegrezza *et al*., 1987; Biondi & Baldoni, 1991; Biondi & Allegrezza, 1996b).

In the present study, we provide a phytosociological analysis of marginal grasslands, as found on road verges, along gravel or clay roads, and in farmhouse courtyards. The aims of this study were thus to conduct a survey of the plant communities that are still present in such mowed and trampled habitats in the countryside, to evaluate their current conservation status, and to highlight their differences in terms of their ecology and morphology, and of the land use, through the application of the floristic-vegetational indices that have been specifically implemented and tested in various agroecosystems (Taffetani & Rismondo, 2009; Rismondo *et al*., 2011; Taffetani *et al*., 2011). For this purpose, we also reconstructed a vegetation transect, which shows the relationships among and between the coenoses detected.

Although these habitats are generally considered to be of little importance and are characterised by low naturalness values, they are often rich in floristic biodiversity, and therefore worth protection (Sycora *et al*., 2002; Wrobel, 2006). The marginal grasslands of the rural contexts have been adversely affected by the abandonment of these areas, with the alteration and elimination of the small surfaces where they grow (Marrs & Frost, 1997; Kahmen & Poschlod, 2008). These last two consequences are a result of rash and damaging management actions, like the large use of herbicides, which is particularly widespread in the study area.

Materials and methods

This vegetation survey was carried out in spring and summer of the years 2009, 2010 and 2011, and mainly between March and April, as most of the coenoses detected consist mainly of early flowering species. We carried out 104 relevés, which included a total of 183 plant species.

The classic phytosociological method of the Zurich-Montpellier Sigmatist School was used, as updated on the basis of the latest acquisitions (Rivas Martínez, 1987; Gehu, 2006; Biondi, 2011; Pott, 2011; Blasi *et al*., 2011). The relevés were defined into tables, which then underwent statistical analyses using the multivariate analysis programme SinTax2000.

The dendrogram shown in Figure 1 was obtained using the weighted pair group method with averaging (WPGMA) and the measure of the similarity ratio. The statistical analysis allowed the separation of the clusters, with each one corresponding to a specific syntaxonomic unit. The ordering of the 104 relevés according to axes of the degree of maturity and of the soil compaction and trampling was achieved through the non-metric multidimensional method, adopting the measure of the similarity ratio. The display of the relevés in a bidimensional graph (Fig. 2) has allowed us to interpret the ecological role of each of the coenoses. After the statistical analysis, syntaxonomical sorting and classification of the relevés was carried out. Each coenosis was assigned to its specific class, order, alliance, association and subassociation or variant, through comparison of the data according to bibliographic contributions and on the basis of their ecological characteristics. A synoptic table was then drawn up and floristic comparisons carried out between the vegetation communities detected (Table 2). The elaboration allowed us to obtain the frequency value for each species within each coenosis (denoted by I, II, III, IV and V; see legend to Table 2). The synoptic table shows the characteristic species of the associations, the species that are always present in each coenosis, and the groups of differential species that were used to distinguish the vegetation communities from each other from an ecological point of view.

Following the syntaxonomic classification, the floristic-vegetational indices were applied (Taffetani & Rismondo, 2009; Rismondo *et al*., 2011). These indices are calculated according to the coverage values, the syntaxonomic classes to which they belong, and the life form of each single species present in the tables of relevés. The numerical values obtained from these analyses give an indication of the ecological conditions and the anthropic disturbances related to each plant community.

From the Index of Maturity (IM), we can deduce the evolutionary levels of the coenoses, on a scale of

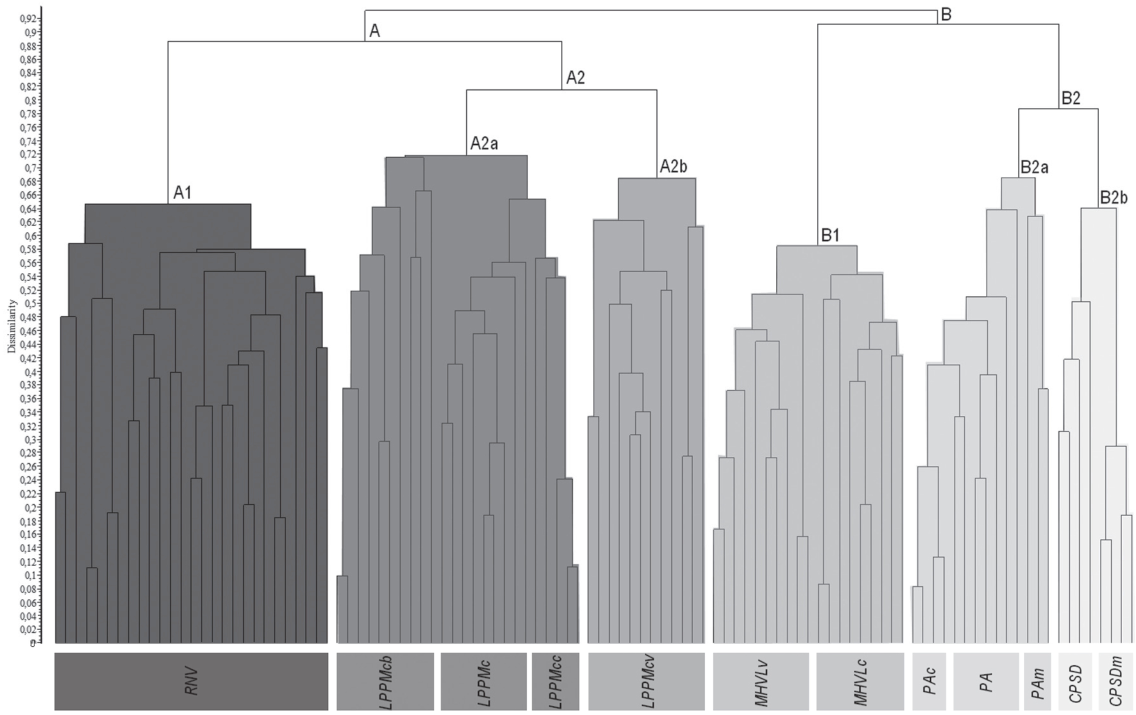

Fig. 1 - Dendrogram of the 104 relevés, as obtained using the weighted pair group method with averaging (WPGMA) and the measurement of the similarity ratio. Legend: *RNV = Ranunculetum neapolitano-velutini*; *LPPMcb = Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni Bromus hordeaceus* variant; *LPPMc = Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni*; *LPPMcc = Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni Cerastium semidecandrum* variant *LPPMcv = Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni Verbena officinalis* facies; *MHVLv = Medicago hispidae-Vulpietum ligusticae vulpietosum ligusticae*; *MHVLc = Medicago hispidae-Vulpietum ligusticae calaminthetosum nepetae*; *PAc = Poetum annuae Cerastium glomeratum* variant; *PA = Poetum annuae*; *Pam = Poetum annuae Medicago hispida* variant; *CPSD = Coronopodo procumbentis-Sclerochloetum durae*; *CPSDm = Coronopodo procumbentis-Sclerochloetum durae Matricaria camomilla* variant.

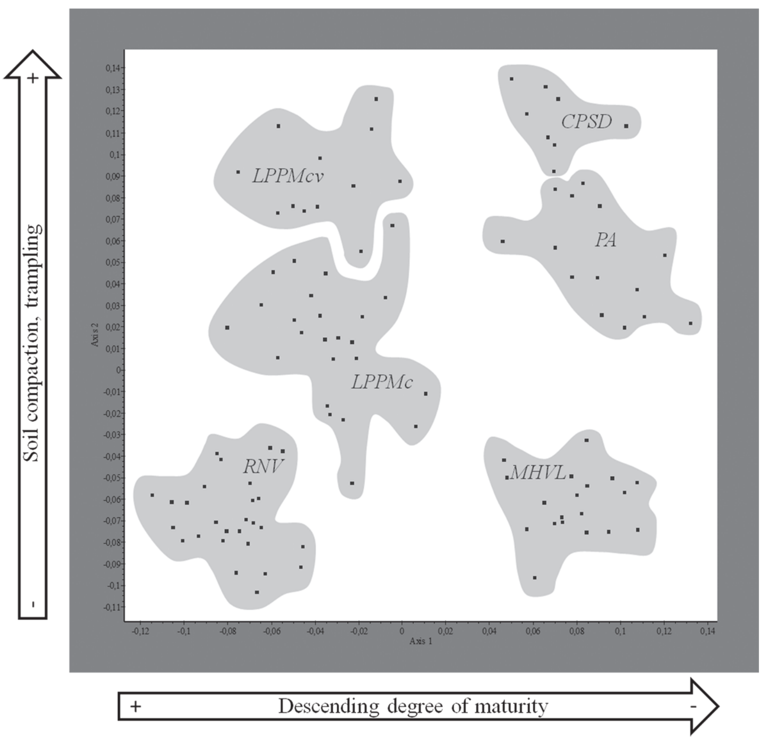

Fig. 2 - Ordering of the 104 relevés according to the degree of maturity and the soil compaction and trampling, obtained through the non-metric multidimensional method and the measure of the similarity ratio.

Legend: *RNV = Ranunculetum neapolitano-velutini* sensu latu;

LPPMc = Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni and variants;

LPPMcv = Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni Verbena officinalis facies;

MHVL = Medicago hispidae-Vulpietum ligusticae sensu latu;

PA = Poetum annuae sensu latu;

CPSD = Coronopodo procumbentis-Sclerochloetum durae sensu latu.

Tabl. 2 - Synoptic table

			RBV	*LPPMc*	*LPPMv*	*MHVL*	*PA*	*CPSD*	presences	total presences
		Char. and diff. species *Ranunculetum neapolitano-velutini*								
H scap	N-MEDIT.	Ranunculus velutinus Ten.	V	II	.	.	.	.	2	32
H scap	EURASIAT.	Ranunculus neapolitanus Ten.	V	III	.	.	.	I	3	38
T scap	AVV.	Veronica persica Poiret	V	IV	I	IV	I	III	6	63
H bienn	PALEOTEMP.	Daucus carota L.	V	III	III	II	.	.	4	44
		Char. and diff. *Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni*								
H caesp	CIRCUMBOR.	Lolium perenne L.	II	V	V	II	II	II	6	49
G rhiz	COSMOP.	Cynodon dactylon (L.) Pers.	I	V	V	II	III	V	6	53
G rhiz	PALEOTEMP.	Convolvulus arvensis L.	II	III	V	III	I	III	6	44
H ros	EURASIAT.	Plantago major L.	I	V	IV	.	IV	II	5	41
T scap	EURIMEDIT.	Medicago arabica (L.) Hudson	II	II	.	II	II	.	4	28
H bienn	CENTRO-EUROP.	Senecio erraticus Bertol.	I	II	.	.	.	.	2	14
		Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni Verbena officinalis facies								
H scap	PALEOTEMP.	Verbena officinalis L.	I	II	V	.	.	II	4	22
T rept	COSMOP.	Polygonum aviculare L.	.	I	III	.	III	V	4	23
T scap	SUBCOSMOP.	Echinochloa crus-galli (L.) Beauv.	.	.	II	.	.	.	1	3
T scap	EURIMEDIT.	Pallenis spinosa (L.) Cass.	.	.	II	.	.	.	1	3
T scap	SUBCOSMOP.	Setaria viridis (L.) Beauv.	.	.	II	.	.	.	1	4
		Char. and diff. *Medicago hispidae-Vulpietum ligusticae*								
T caesp	STENOMEDIT.	Vulpia ligustica (All.) Link	I	I	.	V	I	.	4	25
T scap	EURIMEDIT.	Medicago hispida Gaertner	.	I	I	IV	II	.	4	21
T scap	PALEOTEMP.	Veronica arvensis L.	II	III	.	V	.	.	3	35
H bienn	STENOMEDIT.	Scabiosa maritima L.	.	.	.	II	.	.	1	7
		Char. and diff. species *Poetum annuae*								
T caesp	COSMOP.	Poa annua L.	I	V	II	V	V	V	6	67
		Char. and diff. species *Coronopodo procumbentis-Sclerochloetum durae*								
T scap	EURIMEDIT.	Sclerochloa dura (L.) Beauv.	.	I	.	.	II	V	3	13
T rept	EURIMEDIT.	Coronopus squamatus (Forsskal) Asch.	.	I	.	.	I	IV	3	8
		Differential species *Molinio-Arrhenatheretea* class								
H rept	PALEOTEMP.	Trifolium repens L.	IV	IV	III	I	I	.	5	46
H caesp	PALEOTEMP.	Dactylis glomerata L.	IV	III	III	.	I	.	4	37
H scap	SUBCOSMOP.	Rumex crispus L.	V	II	II	.	.	.	3	34
		Differential species *Artemisietea vulgaris* class								
H bienn	PALEOTEMP.	Silene alba (Miller) Krause	II	II	II	.	I	.	4	19
G rhiz	CIRCUMBOR.	Agropyron repens (L.) Beauv.	I	I	I	.	.	.	3	10
H bienn	PALEOTEMP.	Cirsium vulgare (Savi) Ten.	I	I	I	.	.	.	3	5
H scap	MEDIT.ATL.(STENO)	Salvia verbenaca L.	I	I	I	.	.	.	3	3
		Differential species *Stellarietea mediae* class								
T scap	EURASIAT.	Avena fatua L.	.	II	III	.	.	.	2	12
T scap	AVV.	Conyza canadensis (L.) Cronq.	.	I	II	.	.	.	2	6
T rept	EURIMEDIT.	Anagallis arvensis L.	.	I	I	.	.	.	2	2
		Stellarietea mediae species								
T scap	EURIMEDIT.	Hordeum murinum ssp. leporinum (Link) Arcang.	II	IV	III	IV	IV	I	6	51
T scap	SUBCOSMOP.	Bromus hordeaceus L.	IV	IV	III	V	II	.	5	63

			RBV	*LPPM*	*VOCD*	*MHVL*	*PA*	*CPSD*	presences	total presences
H caesp	PALEOTEMP.	Festuca arundinacea Schreber	I	I	.	.	.	.	2	5
H scap	PALEOTEMP.	Lotus corniculatus L.	I	.	I	.	.	.	2	5
H scap	EUROP.	Centaurea nigrescens Willd. ssp. neapolitana (Boiss.) Dostal	I	I	.	.	.	.	2	4
H caesp	SUBTROP.	Hordeum bulbosum L.	I	I	.	.	.	.	2	3
H rept	PALEOTEMP.	Ranunculus repens L.	I	.	I	.	.	.	2	3
H scap	EURASIAT.	Rumex conglomeratus Murray	.	II	.	.	.	.	1	8
H caesp	EURASIAT.	Anthoxanthum odoratum L.	I	.	.	.	.	.	1	2
G rhiz	EUROP.-CAUC.	Carex hirta L.	I	.	.	.	.	.	1	2
H scap	MEDIT.ATL.(EURI)	Oenanthe pimpinelloides L.	.	I	.	.	.	.	1	2
H rept	CIRCUMBOR.	Agrostis stolonifera L.	I	.	.	.	.	.	1	1
G bulb	EURIMEDIT.	Ornithogalum umbellatum L.	I	.	.	.	.	.	1	1
G rhiz	SUBCOSMOP.	Paspalum paspaloides (Michx.) Scribner	.	.	I	.	.	.	1	1
H scap	PALEOTEMP.	Epilobium tetragonum L.	.	I	.	.	.	.	1	1
H bienn	EURIMEDIT.	Linum bienne Miller	.	I	.	.	.	.	1	1
		Artemisietea vulgaris species								
H scap	EUROSIB.	Malva sylvestris L.	I	II	I	I	I	.	5	11
H scap	PALEOTEMP.	Cichorium intybus L.	III	III	III	III	.	.	4	38
H scap	EUROSIB.	Picris hieracioides L.	IV	I	I	II	.	.	4	30
H scap	CIRCUMBOR.	Artemisia vulgaris L.	I	I	I	I	.	.	4	10
H scap	EURASIAT.	Medicago sativa L.	I	I	I	I	.	.	4	8
H scap	PALEOTEMP.	Cerastium arvense L.	I	II	.	.	.	III	3	11
T scap	MEDIT.ATL.(EURI)	Crepis vesicaria L.	II	I	.	I	.	.	3	11
T scap	EURASIAT.	Geranium molle L.	I	I	.	II	.	.	3	9
H scap	EURASIAT.	Linaria vulgaris Miller	I	.	I	I	.	.	3	4
T scap	PALEOTEMP.	Geranium rotundifolium L.	.	I	.	I	.	.	2	5
H ros	STENOMEDIT.	Hyoseris radiata L.	I	.	.	I	.	.	2	5
H scap	EURIMEDIT.	Inula viscosa (L.) Aiton	I	.	II	.	.	.	2	5
T scap	AVV.	Aster squamatus (Sprengel) Hieron.	.	I	I	.	.	.	2	3
H bienn	EURIMEDIT.	Arctium minus (Hill) Bernh.	I	.	I	.	.	.	2	3
G bulb	CENTRO-MEDIT.	Bellevalia romana (L.) Sweet	II	.	.	.	.	.	1	8
G rhiz	CIRCUMBOR.	Equisetum telmateja Ehrh.	II	.	.	.	.	.	1	6
H bienn	MEDIT.-TURAN.	Carduus pycnocephalus L.	.	I	.	.	.	.	1	3
H scap	W-STENOMEDIT.	Hedysarum coronarium L.	.	.	I	.	.	.	1	2
G rhiz	SUBCOSMOP.	Arundo donax L.	.	I	.	.	.	.	1	1
H scap	EURIMEDIT.	Ballota nigra L.	I	.	.	.	.	.	1	1
Ch suffr	SW-MEDIT.-MONT.	Calendula suffruticosa Vahl	.	.	.	I	.	.	1	1
T scap	MEDIT.-TURAN.	Calepina irregularis (Asso) Thell.	.	.	.	I	.	.	1	1
G rhiz	MEDIT.-TURAN.	Cardaria draba (L.) Desv.	.	.	.	I	.	.	1	1
H scap	S-MEDIT.	Foeniculum vulgare Miller	I	.	.	.	.	.	1	1
T scap	EURASIAT.	Melilotus alba Medicus	.	.	I	.	.	.	1	1
T scap	EURIMEDIT.	Securigera securidaca (L.) Deg. et Dorfl.	.	.	.	I	.	.	1	1
T scap	STENOMEDIT.	Tordylium apulum L.	.	.	.	I	.	.	1	1
G rhiz	PALEOTEMP.	Tussilago farfara L.	I	.	.	.	.	.	1	1
		Festuco-Brometea species								
T scap	PALEOTEMP.	Medicago lupulina L.	I	III	I	II	.	.	4	24
H scap	EURASIAT.	Galium album Miller	III	II	.	I	.	.	3	22
H scap	SE-EUROP.	Achillea collina Becker	I	I	.	.	I	.	3	5
H scap	EUROP.-CAUC.	Galium verum L.	I	.	I	I	.	.	3	5
H scap	CIRCUMBOR.	Prunella vulgaris L.	I	II	.	.	.	.	2	7
H scap	PALEOTEMP.	Sanguisorba minor Scop.	I	.	.	I	.	.	2	4
H scap	STENOMEDIT.	Reichardia picroides (L.) Roth	.	.	.	I	.	.	1	3

T scap	EURASIAT.	Geranium dissectum L.	V	V	.	IV	I	I	5	57
T scap	SUBCOSMOP.	Matricaria chamomilla L.	.	I	II	I	II	IV	5	16
T scap	EURIMEDIT.	Cerastium glomeratum Thuill.	I	.	III	IV	II	.	4	26
T scap	EURASIAT.	Sonchus asper (L.) Hill	III	II	II	I	.	.	4	25
T scap	EURIMEDIT.	Bromus gussonei Parl.	III	II	.	I	I	.	4	22
T scap	EURIMEDIT.	Picris echioides L.	I	II	IV	.	.	I	4	22
T scap	EURIMEDIT.	Sherardia arvensis L.	.	II	I	III	I	.	4	19
T rept	COSMOP.	Stellaria media (L.) Vill.	I	II	.	I	II	.	4	15
T scap	EURIMEDIT.	Avena barbata Potter	II	II	I	I	.	.	4	13
T caesp	SUBCOSMOP.	Lophochloa cristata (L.) Hyl.	.	II	I	I	I	.	4	13
T scap	COSMOP.	Cardamine hirsuta L.	I	I	.	II	.	III	4	10
T scap	STENOMEDIT.	Erodium malacoides (L.) L'Hér.	.	I	I	I	I	.	4	5
T scap	MEDIT.-TURAN.	Vicia sativa L.	IV	III	.	II	.	.	3	34
H bienn	COSMOP.	Capsella bursa pastoris (L.) Medicus	.	I	.	.	II	III	3	11
T scap	EURIMEDIT.	Bromus madritensis L.	.	I	I	I	.	.	3	6
T scap	PALEOTEMP.	Bromus tectorum L.	.	I	I	.	I	.	3	4
T scap	STENOMEDIT.	Lotus ornithopodioides L.	I	I	.	I	.	.	3	3
T scap	EURASIAT.	Lamium purpureum L.	III	.	.	I	.	.	2	14
T scap	EURIMEDIT.	Catapodium rigidum (L.) Hubbard	.	II	.	I	.	.	2	9
T scap	COSMOP.	Euphorbia helioscopia L.	.	I	.	II	.	.	2	8
G rad	EURASIAT.	Cirsium arvense (L.) Scop.	I	.	I	.	.	.	2	6
T scap	EURIMEDIT.	Ammi majus L.	.	.	I	.	I	.	2	3
T scap	EURIMEDIT.	Capsella rubella Reuter	.	.	.	I	I	.	2	3
T scap	EURASIAT.	Veronica hederifolia L.	I	.	.	.	.	II	2	3
T scap	STENOMEDIT.	Cerinthe major L.	II	.	.	.	.	.	1	7
T scap	EURIMEDIT.	Senecio vulgaris L.	.	.	.	II	.	.	1	6
T scap	AVV.	Amaranthus deflexus L.	.	.	I	.	.	.	1	2
T scap	EURIMEDIT.	Anthemis cotula L.	.	.	I	.	.	.	1	2
T scap	EURIMEDIT.	Raphanus raphanistrum L.	.	.	I	.	.	.	1	2
T scap	SUBCOSMOP.	Alopecurus myosuroides Hudson	.	I	.	.	.	.	1	1
T scap	SUBCOSMOP.	Chenopodium album L.	.	.	I	.	.	.	1	1
T scap	EURIMEDIT.	Consolida regalis S. F. Gray	.	.	I	.	.	.	1	1
T scap	EUROSIB.	Euphorbia peplus L.	.	.	.	I	.	.	1	1
T scap	EURIMEDIT.	Filago pyramidata L.	.	.	I	.	.	.	1	1
T scap	EURIMEDIT.	Lolium multiflorum Lam.	.	I	.	.	.	.	1	1
T scap	EUROP.-CAUC.	Myosotis arvensis (L.) Hill	.	I	.	.	.	.	1	1
T scap	STENOMEDIT.	Phalaris paradoxa L.	.	.	I	.	.	.	1	1
T scap	SUBCOSMOP.	Portulaca oleracea L.	.	.	I	.	.	.	1	1
H scap	EURIMEDIT.	Rumex pulcher L.	.	I	.	.	.	.	1	1
T scap	SUBTROP.	Setaria verticillata (L.) Beauv.	.	.	I	.	.	.	1	1
T scap	E-MEDIT.-MONT.	Sinapis alba L.	I	.	.	.	.	.	1	1
T scap	SUBCOSMOP.	Torilis arvensis (Hudson) Link	.	.	I	.	.	.	1	1
		Molinio-Arrhenatheretea species								
H ros	EURASIAT.	Plantago lanceolata L.	V	IV	III	IV	I	.	5	67
H ros	EUROP.-CAUC.	Bellis perennis L.	V	IV	II	I	I	.	5	49
H caesp	EURASIAT.	Poa trivialis L.	IV	V	I	.	I	.	4	43
H ros	PALEOTEMP.	Potentilla reptans L.	IV	III	II	III	.	.	4	41
T rept	PALEOTEMP.	Trifolium resupinatum L.	.	I	II	I	I	.	4	10
H scap	EUROSIB.	Trifolium pratense L.	III	II	.	II	.	.	3	24
H caesp	CIRCUMBOR.	Poa pratensis L.	III	II	.	.	.	.	2	23
H ros	CIRCUMBOR.	Taraxacum officinale Weber (aggregato)	II	I	.	.	.	.	2	13
H caesp	CIRCUMBOR.	Holcus lanatus L.	I	II	.	.	.	.	2	8
H scap	PALEOTEMP.	Mentha longifolia (L.) Hudson	II	.	I	.	.	.	2	8
H scap	EURIMEDIT.	Pulicaria dysenterica (L.) Bernh.	.	II	I	.	.	.	2	8
H bienn	EUROSIB.	Pastinaca sativa L. ssp. urens (Req.) Celak	I	I	.	.	.	.	2	6

H caesp	SUBATL.	Brachypodium rupestre (Host) R. et S.	I	.	.	.	.	.	1	2
G bulb	N-MEDIT.	Anemone hortensis L.	I	.	.	.	.	.	1	1
H caesp	PALEOTEMP.	Bromus erectus Hudson	I	.	.	.	.	.	1	1
H bienn	PALEOTEMP.	Centaurium erythraea Rafn	.	.	I	.	.	.	1	1
H scap	CENTRO-EUROP.	Euphorbia cyparissias L.	I	.	.	.	.	.	1	1
H scap	PALEOTEMP.	Hypericum perforatum L.	.	.	.	I	.	.	1	1
G bulb	EURIMEDIT.	Muscari atlanticum Boiss. et Reuter	.	.	.	I	.	.	1	1
H scap	EURIMEDIT.	Urospermum dalechampii (L.) Schmidt	.	.	.	I	.	.	1	1
		Galio-Urticetea species								
T scap	EURASIAT.	Galium aparine L.	III	I	.	.	.	.	2	15
H scap	EURASIAT.	Cruciata laevipes Opiz	III	I	.	.	.	.	2	13
H scap	STENOMEDIT.	Melissa romana Miller	I	I	.	.	.	.	2	3
G rhiz	SE-EUROP.	Symphytum bulbosum Schimper	I	.	.	.	.	.	1	5
H scap	EURASIAT.	Lamium maculatum L.	I	.	.	.	.	.	1	2
H scap	EUROSIB.	Stachys sylvatica L.	I	.	.	.	.	.	1	2
H scand	PALEOTEMP.	Calystegia sepium (L.) R.Br.	.	I	.	.	.	.	1	1
H scap	E-EUROP.-PONTICA	Galega officinalis L.	I	.	.	.	.	.	1	1
H rept	SE-EUROP.	Glechoma hirsuta W. et K.	I	.	.	.	.	.	1	1
H bienn	MEDIT.ATL.(EURI)	Smyrnium olusatrum L.	I	.	.	.	.	.	1	1
		Tuberarietea guttatae species								
T scap	EURASIAT.	Cerastium semidecandrum L.	I	II	.	I	.	.	3	12
T scap	MEDIT.-TURAN.	Crepis sancta (L.) Babc.	.	.	.	III	I	.	2	5
T scap	STENOMEDIT.	Hypochoeris achyrophorus L.	.	.	.	I	.	.	1	2
T scap	S-MEDIT.	Melilotus sulcata Desf.	.	.	.	I	.	.	1	2
T scap	S-EUROP.-SUDSIB.	Trifolium echinatum Bieb.	.	.	I	.	.	.	1	2
T caesp	EURIMEDIT.	Vulpia ciliata (Danth.) Link	.	I	.	.	.	.	1	2
T scap	SUBCOSMOP.	Arenaria serpyllifolia L.	.	.	.	I	.	.	1	1
T scap	EUROP.-CAUC.	Myosotis ramosissima Rochel in Schultes	.	.	.	I	.	.	1	1
T rept	PALEOTEMP.	Trifolium tomentosum L.	.	.	I	.	.	.	1	1
		Trifolio-Geranietea species								
H scap	OROF. S-EUROP.	Calamintha nepeta (L.) Savi	.	I	I	II	.	.	3	9
H rept	EUROP.-CAUC.	Ajuga reptans L.	I	I	.	.	.	.	2	6
H scap	SUBCOSMOP.	Agrimonia eupatoria L.	I	I	.	.	.	.	2	4
H caesp	EURIMEDIT.	Carex divulsa Stockes	.	I	.	.	.	.	1	2
H scap	S-EUROP.-SUDSIB.	Veronica chamaedrys L.	I	.	.	.	.	.	1	2
Ch rept	EURIMEDIT.	Vinca major L.	I	.	.	.	.	.	1	1
		Polygono-Poetea species								
T scap	EURIMEDIT.	Sagina apetala Ard.	.	.	.	I	I	.	2	2
T scap	EURIMEDIT.	Plantago coronopus L.	.	.	.	I	.	.	1	2
T scap	EURIMEDIT.	Polycarpon tetraphyllum L.	.	.	.	.	I	.	1	1
H caesp	SUBCOSMOP.	Sagina procumbens L.	.	.	.	.	I	.	1	1
		Other species								
T scap	PALEOTEMP.	Trifolium campestre Schreber	.	II	I	I	.	.	3	11
T scap	S-EUROP.	Xanthium italicum Moretti	.	I	.	.	I	.	2	2
G rhiz	STENOMEDIT.	Arum italicum Miller	II	.	.	.	.	.	1	7
T rept	EURIMEDIT.	Trifolium scabrum L.	.	.	.	II	.	.	1	5
T scap	EURIMEDIT.	Hainardia cylindrica (Willd.) Greuter	.	.	I	.	.	.	1	2
H scap	EURIMEDIT.	Beta vulgaris L.	.	I	.	.	.	.	1	1
T caesp	COSMOP.	Juncus bufonius L.	.	I	.	.	.	.	1	1
H caesp	PALEOTEMP.	Poa bulbosa L.	.	.	.	I	.	.	1	1
G bulb	EURASIAT.	Ranunculus ficaria L.	I	.	.	.	.	.	1	1

0-9. The Index of Floristic Biodiversity biodiversity (IFB) provides the average number of species for each plant community. The indices of the life forms are expressed as the therophyte coverage (IT; %), the hemicryptophyte coverage (IH; %), and the perennial non-hemicryptophyte coverage (IF; %). These thus analyse the percentages cover of the annual and perennial species of each coenosis.

The scheme that illustrates the succession of the plant communities of the dirt roads was drawn-up to explain the relationships that exist among the coenoses, and the ecological, morphological and land-use features of the sites where they develop.

The taxonomic nomenclature is in accordance with Pignatti (1982) and Conti *et al*. (2005), while for the phytosociological nomenclature of the high syntaxonomic levels, we refer to Rivas Martínez *et al*. (2002).

Results

Phytosociological characterisation

Statistical analysis

The statistical analysis is summarised in Figure 1 and Figure 2. The two branches of the dendrogram that separate at the high level show the largest dissimilarity, and are named as A and B (Fig. 1). The first branch (A) groups together the coenoses that are mainly composed of perennial species. These vegetation communities, which belong to the class *Molinio-Arrhenatheretea*, are subject to periodic mowing and to low-to-moderate trampling. The second branch (B) includes the relevés characterised by a predominance of therophyte plants. These were carried out mainly on the dirt roads, and the relevés have been assigned to coenoses that belong to the classes *Stellarietea mediae* and *Polygono-Poetea*.

The A cluster is subdivided into the subclusters of A1 and A2 (Fig. 1). The first of these brings together the periodically mowed meadows and the slightly trampled grasslands. These vegetation communities are dominated by *Ranunculus velutinus* and *Ranunculus neapolitanus*, and they are assigned to the new association *Ranunculetum neapolitano-velutini*, which belongs to the order *Arrhenatheretalia elatioris*. The second subcluster (A2) groups together the vegetation communities that belong to the class *Molinio-Arrhenatheretea*, which are characterised by slight or moderately greater trampling, and that belong to the order *Plantaginetalia majoris*, to the alliance *Lolio perennis-Plantaginion majoris* and to the association *Lolio perennis-Plantaginetum majoris*, dominated by the species *Lolium perenne* and *Plantago major*. Within this cluster, two further subunits can be distinguished, as A2a and A2b (Fig. 1). These group together, respectively, the subassociation *cynodontetosum dactyloni*, and its *Verbena officinalis* facies.

Cluster B is also subdivided into the two subclusters, B1 and B2 (Fig. 1). The former is related to relevés with a prevalence of *Vulpia ligustica* and with the presence of many other therophyte species belonging to the class *Stellarietea mediae*. These relevés are assigned to the new association *Medicago hispidae-Vulpietum ligusticae*. The association includes two subassociations, the typus *vulpietosum ligusticae*, and *calaminthetosum nepetae*.

The other subcluster, B2, brings together the vegetation communities of the class *Polygono-Poetea*. These are characterised by plants that show the highest resistance to trampling. These are more closely related to the habitat of the dirt roads, which are made of clay or gravel. The subcluster B2 is divided into the subunits of B2a and B2b. The relevés related to these two subsets are assigned to the associations *Poetum annuae* and *Coronopodo procumbentis-Sclerochloetum durae*, respectively.

The statistical analysis also allowed the identification of five variants: *Cerastium semidecandrum* and *Bromus hordeaceus* variants for *Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni*; *Cerastium glomeratum* and *Medicago hispida* variants for *Poetum annuae*; *Matricaria chamomilla* variant for *Coronopodo procumbentis-Sclerochloetum durae*. The ordering of the relevés using the non-metric multidimensional method clearly shows the separation of six vegetation types (Fig. 2). Along axis 1, the plant communities are arranged from right to left according to their decreasing level of maturity. On the left we find the coenosis of the class *Molinio-Arrhenatheretea*, which is characterised by a good evolutionary level and by the prevalence of perennial species. On the right, there are the more intensively disturbed coenoses. These are particularly rich in therophyte species of the pioneer classes *Polygono-Poetea* and *Stellarietea mediae*.

Axis 2 shows the degree of disturbance related to the soil compaction and trampling (Fig. 2). The vegetation communities that can develop with greater disturbance levels are in the upper part of the graph. This happens both in the group of perennial coenoses and in that of the therophytic coenoses. Among the associations that belong to the class *Molinio-Arrhenatheretea*, *Verbena officinalis* facies of *Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni* shows the highest tolerance towards compact soils. This is followed by *Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni* and *Ranunculetum neapolitano-velutini*.

Among the therophytic communities, those belonging to the class *Polygono-Poetea* are characterised by the highest resistance to compact soils. The most resistant is *Coronopodo procumbentis-Sclerochloetum durae*. This is followed by *Poetum annuae* and *Medicago hispidae-Vulpietum ligusticae*. This latter is located in the lower right part of the graph (Fig. 2).

Floristic analysis

The floristic analysis is shown in the synoptic table (Table 2). This allowed the extraction of groups of species from which it has been possible to highlight the ecological differencies and similarities among the coenoses. A small group of species was detectable in all of the treated phytocoenoses. This group consisted of *Hordeum murinum* ssp. *leporinum* and *Veronica persica* (class *Stellarietea mediae*), *Poa annua* and *Cynodon dactylon* (class *Polygono-Poetea*), *Convolvulus arvensis* (class *Artemisietea vulgaris*) and *Lolium perenne* (class *Molinio-Arrhenatheretea*). The vegetation communities that belong to the class *Molinio-Arrhenatheretea* are differentiated by some perennial species. Their presence is more rare, or indeed null, in the therophytic coenoses. This is due to the competition exerted by some plants, which are more adapted to grow in habitats characterised by the regular passage of tractors and the consequent greater soil compaction. This group is composed of *Trifolium repens*, *Dactylis glomerata* and *Rumex crispus*, which belong to the class *Molinio-Arrhenatheretea*, and *Silene alba*, *Agropyron repens*, *Cirsium vulgare* and *Salvia verbenaca*, of the class *Artemisietea vulgaris*. These latter four species probably indicate the influence of the contact with less-evolved communities, such as old fields that are not regularly mowed.

Among the plant communities belonging to the class *Molinio-Arrhenatheretea*, *Lolio perennis-Plantaginetum majoris* and its *Verbena officinalis* facies are slightly or moderately resistant to trampling. These coenoses are characterised by the exclusive presence of the therophyte species *Avena fatua*, *Conyza canadensis* and *Anagallis arvensis*, which are commonly represented in the vegetation of arable lands and in other synanthropic coenoses. These three species are absent in the association *Ranunculetum neapolitano-velutini*. This is characterised instead by homogeneous coverage by hemicryptophyte species, which hinder the entrance of the above-mentioned species.

Avena fatua, *Conyza canadensis* and *Anagallis arvensis* are not even present in the coenoses of cluster B, probably because they cannot compete with the small sized species that are adapted to survive in very compacted soils with lower water content.

This floristic analysis also indicated the groups of characteristic and differential species of the associations and of the *Verbena officinalis* facies (belonging to *Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni*). This argument will be treated further in the sections devoted to descriptions of the coenoses.

Vegetation types

Ranunculetum neapolitano-velutini ass. nova (Table 3; type rel. no. 16)

This coenosis is dominated by *Ranunculus velutinus* and *Ranunculus neapolitanus*. It develops in the spring and reaches its maximum biomass production in late April. This vegetation community grows on wet soils that are well provided with nutrients and organic matter. It has been detected mainly on flat ground, and it can be seen particularly in the valley bottoms, and often in farmhouse courtyards.

This phytocoenosis was probably favoured by the traditional human activities, such as the breeding of farm animals, which favours an increase in nutrients and organic matter and slight compacting of the soil, and the mowing, which is usually performed at least once a year, in spring. The abandonment of many rural houses in the study area and of their related productive activities probably represents the greatest hazard for the conservation of this plant community.

From the literature, no associations with a dominance of the two species of buttercup have been described yet. The coenosis *Hordeo-Ranunculetum velutini* (which belongs to the alliance *Ranunculion velutini*, to the order *Trifolio-Hordeetalia*,and to the class *Molinio-Arrhenatheretea*) was detected in the karst plains of the central Apennines, in sites that are characterised by cyclic floods and short dry periods during the summer (Pedrotti, 1982a; Pedrotti 1982b; Pedrotti *et al*., 1992; Venanzoni, 1992). This community does not correspond to the one that we observed, because of clear floristic differencies. Indeed, the characteristic species of the association *Hordeo-Ranunculetum velutini* were not present in our relevés.

Another association characterised by the presence, among the dominant species, of *Ranunculus velutinus*, is *Centaureo neapolitanae-Ranunculetum velutini*. This coenoses was detected in Sant'Anatolia di Narco, in the Umbria Region, central Italy (Biondi *et al*., 2011). This type of vegetation is regularly mowed and stands in contact with hornbeam woods of the association *Scutellario-Ostryetum carpinifoliae*, at altitudes of about 600 m a.s.l. It is referred to the alliance *Ranunculo neapolitani-Arrhenatherion elatioris* (Allegrezza & Biondi, 2011) and to the order *Arrhenatheretalia elatioris*. Some species which are not found in our investigation, are present in the association *Centaureo neapolitanae-Ranunculetum velutini*, as *Leucanthemum vulgare*, *Colchicum*

Tab. 3 - *Ranunculetum neapolitano-velutini* ass. nova

			Relevé number (table 2)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16*	17	18	19	20	21	22	23	24	25	26	27	Presences
			Altitude (m a.s.l.)	140	140	70	485	485	170	170	25	25	45	15	225	260	125	125	125	125	155	155	155	200	120	120	65	45	50	110	
			Aspect	ENE	ENE	-	-	N	N	N	-	-	NE	SE	-	-	-	SSE	-	-	-	-	-	E	-	-	NNW	-	-	-	
			Slope (°)	5	5	-	-	5	5	5	-	-	5	5	-	-	-	5	-	-	-	-	-	5	-	-	5	-	-	-	
			Cover (%)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	
			Area (m^2)	30	40	10	50	50	60	60	40	40	100	90	80	100	50	50	50	60	80	40	40	60	40	40	40	15	20	40	
			Characteristic and differential species *Ranunculetum neapolitano-velutini* and *Ranuncolo neapolitani-Arrhenatherion elatioris*																												
H scap	N-MEDIT.	t	Ranunculus velutinus Ten.	1	1	+	1	+	4	4	3	4	5	4	5	5	4	4	4	5	5	4	3	5	4	4	4	4	4	5	27
H scap	EURASIAT.	t	Ranunculus neapolitanus Ten.	3	4	4	3	4	4	3	1	2	+	+	+	+	3	3	1	+	1	1	1	1	2	2	1	.	+	+	26
T scap	AVV.	d	Veronica persica Poiret	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	.	+	+	+	+	1	+	1	+	+	26
H bienn	PALEOTEMP.	d	Daucus carota L.	1	+	1	1	1	+	1	.	+	+	+	1	+	1	+	+	+	+	+	+	+	+	+	1	+	.	1	25
H scap	EURASIAT.		Galium album Miller	.	+	.	1	1	+	1	+	+	.	.	1	+	.	.	.	+	.	1	2	.	.	.	.	1	.	+	14
H bienn	EUROSIB.		Pastinaca sativa L. ssp. urens (Req.) Celak	.	.	.	1	1	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	.	.	5
H scap	EUROP.		Centaurea nigrescens Willd. ssp. neapolitana (Boiss.) Dostal	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	3
H scap	SE-EUROP.		Achillea collina Becker	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
			Characteristic species *Arrhenatheretalia elatioris, Molinio-Arrhenatheretea*																												
H ros	EURASIAT.		Plantago lanceolata L.	1	1	1	1	1	2	2	1	1	1	1	+	+	1	1	1	1	+	1	1	1	1	1	.	+	+	1	26
H scap	SUBCOSMOP.		Rumex crispus L.	+	+	1	+	1	.	+	+	1	+	+	+	+	.	+	+	+	+	.	+	1	+	+	+	+	1	+	24
H ros	EUROP.-CAUC.		Bellis perennis L.	1	1	1	+	+	1	1	+	+	1	1	.	+	+	+	+	1	+	+	1	.	.	+	1	.	+	1	23
H caesp	PALEOTEMP.		Dactylis glomerata L.	3	2	1	1	1	+	+	2	+	.	2	.	.	1	+	+	.	.	+	+	1	.	.	2	1	.	2	19
H rept	PALEOTEMP.		Trifolium repens L.	.	.	2	.	.	.	.	.	.	+	.	+	+	1	+	+	3	1	2	1	+	+	1	1	+	+	1	18
H caesp	EURASIAT.		Poa trivialis L.		.	+	1	1	.	.	2	2	1	+	2	2	1	2	+	+	2	2	2	+	.	.	.	.	.	1	18
H ros	PALEOTEMP.		Potentilla reptans L.		1	2	+	.	.	.	1	+	.	1	1	1	+	.	+	+	+	.	.	.	.	1	1	2	1	1	17
H caesp	CIRCUMBOR.		Poa pratensis L.	.	.	.	+	+	.	+	.	.	.	2	1	1	1	.	+	2	1	2	1	2	.	1	.	.	2	2	16
H scap	EUROSIB.		Trifolium pratense L.	.	.	.	+	+	1	1	2	+	2	2	+	3	.	.	.	.	+	.	+	.	.	.	.	.	1	.	13
H ros	CIRCUMBOR.		Taraxacum officinale Weber (aggregato)	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	.	+	1	.	+	+	.	.	1	+	9
T scap	EURIMEDIT.		Medicago arabica (L.) Hudson	2	2	.	1	1	.	.	+	.	1	1	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	8
H scap	PALEOTEMP.		Mentha longifolia (L.) Hudson		.	.	+	1	.	.	.	.	+	.	.	.	1	+	2	.	.	.	+	.	.	.	.	.	.	.	7
H caesp	CIRCUMBOR.		Lolium perenne L.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	1	+	.	1	1	.	.	.	.	6
H scap	PALEOTEMP.		Verbena officinalis L.		.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	+	.	.	.	.	5
H bienn	CENTRO-EUROP.		Senecio erraticus Bertol.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	+	.	+	5
H caesp	PALEOTEMP.		Festuca arundinacea Schreber	.	.	.	+	+	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
H scap	PALEOTEMP.		Lotus corniculatus L.	+	.	.	.	.	.	.	1	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
G rhiz	EUROP.-CAUC.		Carex hirta L.		.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	1	.	.	.	.	.	.	2
H rept	PALEOTEMP.		Ranunculus repens L.		.	.	.	.	.	.	.	.	.	.	.	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	2
H caesp	EURASIAT.		Anthoxanthum odoratum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	2
H caesp	CIRCUMBOR.		Holcus lanatus L.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
H caesp	SUBTROP.		Hordeum bulbosum L.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	2
G bulb	EURIMEDIT.		Ornithogalum umbellatum L.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
H rept	CIRCUMBOR.		Agrostis stolonifera L.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
H ros	EURASIAT.		Plantago major L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1
			Characteristic species *Artemisietea vulgaris*																												
H scap	EUROSIB.		Picris hieracioides L.	+	+	+	+	+	.	+	1	+	.	+	+	+	+	+	+	+	+	+	+	.	.	+	.	.	.	.	19
H scap	PALEOTEMP.		Cichorium intybus L.	.	.	+	+	+	.	1	+	.	.	.	.	.	+	+	.	.	1	+	+	1	+	+	.	.	.	.	13
H bienn	PALEOTEMP.		Silene alba (Miller) Krause	.	.	.	.	.	+	+	.	.	+	+	.	+	.	.	.	+	.	.	.	.	.	+	+	.	1	.	9
G bulb	CENTRO-MEDIT.		Bellevalia romana (L.) Sweet	1	+	+	.	.	.	.	.	.	+	+	+	.	.	.	.	.	1	.	.	.	.	.	1	.	.	.	8
G rhiz	PALEOTEMP.		Convolvulus arvensis L.	.	.	.	+	+	.	+	.	.	.	+	.	.	.	.	.	+	.	+	+	+	.	.	.	.	.	.	8
T scap	MEDIT.ATL.(EURI)		Crepis vesicaria L.	+	+	.	1	2	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	7

G rhiz	CIRCUMBOR.	Agropyron repens (L.) Beauv.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1	+	.	1	1	.	.	.	.	5
H scap	CIRCUMBOR.	Artemisia vulgaris L.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	.	.	.	.	4
H bienn	PALEOTEMP.	Cirsium vulgare (Savi) Ten.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	3
H scap	EURASIAT.	Medicago sativa L.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	3
T scap	EURIMEDIT.	Picris echioides L.	.	.	.	.	.	.	.	.	.	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
H bienn	EURIMEDIT.	Arctium minus (Hill) Bernh.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	2
H ros	STENOMEDIT.	Hyoseris radiata L.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
H scap	EURIMEDIT.	Inula viscosa (L.) Aiton	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
T scap	EURASIAT.	Geranium molle L.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	2
H scap	EURASIAT.	Linaria vulgaris Miller	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	1	.	.	2
H scap	EURIMEDIT.	Ballota nigra L.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
H scap	MEDIT.ATL.(STENO)	Salvia verbenaca L.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
H scap	S-MEDIT.	Foeniculum vulgare Miller	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
H scap	EUROSIB.	Malva sylvestris L.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
G rhiz	PALEOTEMP.	Tussilago farfara L.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
		Other species																												
T scap	EURASIAT.	Geranium dissectum L.	1	1	1	1	1	+	+	1	1	1	1	.	+	2	3	1	1	1	1	+	1	+	1	1	.	.	.	23
T scap	SUBCOSMOP.	Bromus hordeaceus L.	.	.	1	+	.	+	1	.	.	+	.	+	.	+	1	+	1	2	+	+	1	1	+	.	+	.	+	18
T scap	MEDIT.-TURAN.	Vicia sativa L.	+	1	+	1	1	1	2	+	+	+	+	+	.	.	.	.	.	+	1	+	+	.	.	1	+	.	.	18
T scap	EURASIAT.	Lamium purpureum L.	.	+	.	.	.	.	.	.	.	.	+	.	+	+	+	+	.	+	.	.	.	+	+	+	+	+	+	13
T scap	EURASIAT.	Sonchus asper (L.) Hill	.	.	.	1	1	+	+	.	.	+	+	+	+	.	.	.	+	.	1	+	.	1	+	.	.	.	.	13
T scap	EURASIAT.	Galium aparine L.	+	+	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	+	.	1	+	+	+	+	+	+	12
T scap	EURIMEDIT.	Bromus gussonei Parl.	.	.	.	1	+	+	1	.	.	.	.	+	.	.	.	.	+	+	+	+	1	2	2	.	.	.	.	12
H scap	EURASIAT.	Cruciata laevipes Opiz	.	.	.	1	1	+	+	.	1	.	.	.	.	.	.	.	.	.	1	1	+	1	2	2	.	.	.	11
G rhiz	STENOMEDIT.	Arum italicum Miller	1	+	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	+	+	.	7
T scap	STENOMEDIT.	Cerinthe major L.	.	.	.	.	.	2	1	.	.	.	.	.	.	.	.	+	.	+	1	+	+	.	.	.	.	.	.	7
T scap	PALEOTEMP.	Veronica arvensis L.	.	.	.	+	+	.	.	.	.	+	+	+	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	7
G rhiz	CIRCUMBOR.	Equisetum telmateja Ehrh.	.	.	.	1	+	.	.	.	.	.	.	.	.	+	+	1	.	.	.	.	.	.	.	.	+	.	.	6
T scap	EURIMEDIT.	Avena barbata Potter	.	.	.	+	+	.	.	.	.	.	.	.	.	.	+	.	.	.	+	+	1	.	.	.	.	.	.	6
T scap	EURIMEDIT.	Hordeum murinum ssp. leporinum (Link) Arcang.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	+	.	+	.	.	.	.	+	+	.	.	.	.	6
T scap	PALEOTEMP.	Medicago lupulina L.	.	1	1	.	.	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
G rhiz	SE-EUROP.	Symphytum bulbosum Schimper	.	.	.	.	.	.	.	.	+	.	+	.	.	1	.	1	.	.	.	.	.	.	.	.	.	+	.	5
T scap	EURIMEDIT.	Cerastium glomeratum Thuill.	.	.	.	.	.	.	.	.	+	.	.	+	+	.	.	.	+	+	.	.	.	.	.	.	.	.	.	5
H rept	EUROP.-CAUC.	Ajuga reptans L.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	+	+	.	.	.	.	.	.	.	.	.	.	+	5
		Sporadic species	2	0	1	4	4	2	0	0	2	3	2	4	2	2	0	0	0	0	2	2	1	3	4	2	0	2	3	

lusitanum, *Avenula pratensis* and *Tragopogon pratensis*. However the coenosis detected is characterized by the almost constant presence of the species *Ranunculus neapolitanus*, *Veronica persica* and *Daucus carota*. We don't consider appropriate to refer our relevés to the association *Centaureo neapolitanae-Ranunculetum velutini*, because of clear floristic, syntaxonomic, dynamic and altitudinal differences.

A coenosis with a dominance of *Arrhenatherum elatius* and a presence of *Ranunculus velutinus* and *Ranunculus neapolitanus* has been recently described for the eastern-central sector of the Italian peninsula. It has been called *Ranunculo neapolitani-Arrhenatheretum elatioris* (Allegrezza & Biondi, 2011). The subassociation *ranunculetosum velutini* has also been observed. *Ranunculo neapolitani-Arrhenatheretum elatioris* has been detected in the Marche and Umbria regions, at altitudes of more than 440 m a.s.l. It usually develops on alluvial soils and it is defined as the typus association of the new alliance *Ranunculo neapolitani-Arrhenatherion elatioris*. The subassociation has been described for sites characterised by long water-logging (Allegrezza & Biondi, 2011). However, we cannot refer our relevés to this association because of the lack of the characteristic species *Arrhenatherum elatius*, and due to the lower altitudes of the study area.

In agreement with the above, we propose the new association *Ranunculetum neapolitano-velutini*. We assign this coenosis to the alliance *Ranunculo neapolitani-Arrhenatherion elatioris* and to the order *Arrhenatheretalia elatioris*, which are the most represented syntaxa. We suggest the following diagnostic species: *Ranunculus velutinus* (transgressive of the alliance *Ranunculion velutini*), *Ranunculus neapolitanus* (transgressive of the alliance *Ranunculion velutini*), *Veronica persica* (differential of the class *Stellarietea mediae*) and *Daucus carota* (differential of the class *Artemisietea vulgaris*). These four species are the ones characterised by the highest frequencies (Table 2). The other well-represented species of this coenosis are *Rumex crispus*, *Potentilla reptans*, *Plantago lanceolata*, *Bellis perennis*, *Dactylis glomerata* and *Poa trivialis*, all of which belong to the class *Molinio-Arrhenatheretea*. The association *Ranunculetum neapolitano-velutini* always includes also a group of synanthropic species and entities of the old fields belonging to the class *Artemisietea vulgaris*, such as *Picris hieracioides*, *Cichorium intybus, Silene alba* and others. These taxa indicate the contact with coenosis belonging to the same class.

We propose the inclusion of this association in the Habitat 6510 (Lowland hay meadows) according to the Italian Interpretation Manual of the 92/43/EEC Directive Habitats.

Lolio perennis-Plantaginetum majoris (Linkola 1921) Beger 1930 (Table 4)

cynodontetosum dactyloni subass. nova (Table 4, type rel. no. 2)

The association *Lolio perennis-Plantaginetum majoris* has been frequently observed in the study area. It has also been detected in several other hilly and mountain localities of the Marche and Abruzzo regions (Pedrotti, 1967; Cortini Pedrotti *et al*., 1973; Hruska, 1982a; Hruska, 1982b; Pirone, 1983; Pirone & Ferretti, 1999).

This coenosis grows mainly in areas characterised by frequent mowing and slight or moderate trampling. This is due to the passage of vehicles or to the grazing of livestock and farmyard animals. This vegetation community is characterised by a flattened and prostrate aspect, given by *Plantago major* and other perennial rosette species (Andreucci, 2006). It is linked to moist and nutrient-rich soils, and reaches its maximum development in the middle of spring, followed by drying up in summer.

From the syntaxonomic point of view, the attribution of this coenosis to higher levels has been the subject of several interpretations. With regard to the Adriatic Italian sector, some authors include it in the alliance *Polygonion avicularis* (currently assigned to the class *Polygono-Poetea*), of the order *Plantaginetalia majoris* and in the class *Plantaginetea* (which was considered to be a separate class from *Molinio-Arrhenatheretea*, with which it is now synonymous) (Pedrotti *et al*., 1973; Hruska, 1982a; Hruska, 1982b; Pirone, 1983). This plant community was previously assigned to the alliance *Agropyro-Rumicion crispi*, as part of the order *Plantaginetalia majoris* and of the class *Plantaginetea* (Pedrotti, 1967). In relation to the north-eastern Adriatic area, this association has also been reported in Karst and continental Croatia (Markovic-Gospodaric, 1965; Poldini, 1989). Even in these cases, the same coenosis is assigned to the alliance *Polygonion avicularis*, to the order *Plantaginetalia majoris* and to the class *Plantaginetea*. It has been detected in other locations of the Balkan Peninsula as well, with its attribution to the alliance *Polygonion avicularis*, to the order *Plantaginetalia majoris* and to the class *Chenopodietea* (currently a synonym for *Stellarietea mediae*) (Segulja, 1970; Birac, 1973; Hulina, 1973).

The association *Lolio perennis-Plantaginetum majoris* is currently included in the alliance *Plantaginion majoris*, in the order *Plantaginetalia majoris* and in the class *Molinio-Arrhenatheretea* (Rivas Martínez, 1975; Andreucci, 2006), due to the predominance of perennial hemicryptophyte species that belong to these syntaxa. The most representative entities of this coenosis are the two characteristic species of *Lolium perenne* and *Plantago major* (Birac, 1973), both of which are adapted to survival in habitats that are exposed to moderate or high trampling and to soil compaction.

In the study area *Lolio perennis-Plantaginetum majoris* is characterised by the almost constant presence, in addition to *Plantago major* and *Lolium perenne*, of two ruderal geophyte species such as *Cynodon dactylon* and *Convolvulus arvensis*. These taxa, together with *Ranunculus neapolitanus*, *Senecio erraticus* and *Medicago arabica*, are the diagnostic entities of the new subassociation *cynodontetosum dactyloni*. These latter three species are transgressive of the class *Molinio-Arrhenatheretea* and highlight the mesophilous nature of the subassociation *cynodontetum dactyloni*. The other most representative species of the higher hierarchical levels are *Poa trivialis*, *Bellis perennis*, *Plantago lanceolata* and *Trifolium repens*.

With respect to the typus association this community is able to establish itself where anthropic disturbance is a little higher. Species that constitute it, can withstand the impact on the ground caused by the passage of vehicles. This is due to their basal rosettes or stolons. This coenosis can also be seen at the side or the centre of the dirt roads, when disturbance and trampling are not excessive. It has also been detected in farmhouse courtyards with very compacted soils, which are mainly of clay or gravel.

Among the companion species, in addition to *Poa annua*, belonging to the class *Polygono-Poetea*, some entities of the *Stellarietea mediae* class are also well represented. These species are *Geranium dissectum*, *Veronica persica* and *Hordeum murinum* ssp. *leporinum*, and they emphasise the ruderal character of the coenosis.

Cerastium semidecandrum variant (Table 4)

The *Cerastium semidecandrum* variant has been detected under increasing water stress conditions due to soil erosion. This condition is due to the more compact soils and to the low capacity for water retention of the most superficial layer of the ground. The increase in this ecological stress condition is highlighted by the presence of annual species which exert the recolonization of the substrate, like *Cerastium semidecandrum*, *Stellaria media* and *Trifolium campestre*. In this coenosis, it is possible to detect the rarefaction of *Lolium perenne* and a higher coverage attributable to *Plantago major* (usually between 41% and 60%). Among these two, the latter is probably the most adaptable to survive with highly compaced soils. This variant was identified by the sequence of relevés 10 to 14.

Bromus hordeaceus variant (Table 4)

The *Bromus hordeaceus* variant has been detected in contact with the association *Ranunculetum neapolitano-velutini*, on small, slightly trampled areas, in the farmhouse courtyards. It is characterised by *Bromus hordeaceus*, *Poa pratensis*, *Ranunculus velutinus*, *Crepis vesicaria* and *Bromus gussonei*. These species are also well represented in the buttercup meadows described above. Among the two diagnostic species of the association, *Lolium perenne* is dominant with respect to *Plantago major*, which instead is often absent. This grassland is mainly composed of the larger sized species, while the prostrate entities that are more resistant to soil compaction and trampling are more rare. This indicates that the *Bromus hordeaceus* variant develops under conditions of less disturbance, when compared to the typus association. This variant is identified by the subunit that groups the relevés from 15 to 24.

Verbena officinalis facies

The *Verbena officinalis* facies is widely observed in the study area. Its presence is linked to soil compaction due to trampling and the passage of motor vehicles. In the territory analysed, this degradation aspect of *Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni* can be frequently seen on the verges or on the central grassy bump of the country roads. It often also occurs on the turning areas at the heads of the fields and between the rows in vineyards or between other tree crops. In the situations that we observed here, its development also appears to be favoured by the systematic use of herbicides.

The *Verbena officinalis* facies tends to grow under conditions of reduced water availability and further increased disturbance, when compared to the subassociation *Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni*.

This community is characterised by *Verbena officinalis* and by other late flowering entities, such as *Pallenis spinosa*, *Polygonum aviculare*, *Setaria viridis*, *Echinochloa crus-galli*. The first is a mediterranean species that indicates the thermophylous attitude of the coenosis, while the others are cosmopolitan therophytes that are commonly represented in the vegetation of the summer crops, and which highlight that the facies is a ruderal and degraded aspect of the subassociation.

In addition to the constant presence of *Verbena officinalis* and to the almost exclusive presence of the other aforementioned therophyte species, with respect to the subassociation *cynodontetosum dactyloni*, we can also observe the increasing cover values of *Cynodon dactylon* and *Convolvulus arvensis*, and the lower coverage exerted by *Plantago major* and *Lolium perenne*. Furthermore, the three transgressive species of the subassociation *cynodontetosum dactyloni*, *Ranunculus neapolitanus*, *Senecio erraticus* and *Medicago arabica*, are not represented in the *Verbena officinalis* facies. These entities tend to disappear with

Tab. 4 - *Lolio perennis-Plantaginetum majoris* (Linkola 1921) Beger 1930
cynodontetosum dactyloni subass. nova
Cerastium semidecandrum variant
Bromus hordeaceus variant
Verbena officinalis facies

				1	2*	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
			Relevé number (table 3)	1	2*	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	Presences
			Altitude (m a.s.l.)	30	30	80	20	45	45	45	80	60	45	110	55	55	55	155	155	120	120	200	200	165	125	120	40	95	85	105	35	40	45	45	30	210	180	180	135	
			Aspect	-	-	W	-	-	-	-	-	-	-	NW	-	-	-	-	-	-	-	-	-	SW	NNE	-	-	SE	SE	S	-	-	-	-	-	SE	-	-	-	
			Slope (°)	-	-	10	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	5	15	-	-	5	5	20	-	-	-	-	-	5	-	-	-	
			Cover (%)	90	100	100	100	100	100	100	100	100	100	80	100	100	100	100	100	100	100	100	100	100	100	100	85	50	80	100	95	100	100	100	100	80	100	100	100	
			Area (m²)	7	15	10	20	20	20	20	5	30	10	5	5	5	4	30	20	30	40	5	10	15	10	50	30	5	3	8	30	40	50	35	20	10	10	10	15	
			Characteristic species *Lolio perennis-Plantaginetum majoris*																																					
H caesp	CIRCUMBOR.		Lolium perenne L.	4	3	4	4	4	4	4	3	3	3	+	.	+	1	4	3	3	2	3	1	3	1	+	+	1	3	2	2	2	+	1	2	3	1	2	.	34
H ros	EURASIAT.		Plantago major L.	1	2	1	+	1	2	1	1	2	3	2	3	3	3	1	2	.	+	+	+	.	.	.	+	.	+	1	1	.	1	+	+	1	.	1	1	29
			Differential species *cynodontetosum dactyloni* subass. nova																																					
G rhiz	COSMOP.		Cynodon dactylon (L.) Pers.	1	+	2	1	+	+	2	1	2	1	.	+	1	1	+	+	2	+	.	.	.	1	1	1	2	3	4	4	4	5	4	4	4	4	4	5	32
G rhiz	PALEOTEMP.		Convolvulus arvensis L.	+	+	.	.	.	+	1	.	2	.	.	.	.	.	+	+	1	1	.	+	.	.	.	1	+	1	2	1	2	2	3	+	+	+	+	1	23
H scap	EURASIAT.	t	Ranunculus neapolitanus Ten.	.	+	+	.	+	.	.	+	.	.	.	+	.	.	+	+	1	1	.	.	2	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	11
H bienn	CENTRO-EUROP.	t	Senecio erraticus Bertol.	.	1	+	.	.	.	.	1	1	1	+	+	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9
T scap	EURIMEDIT.	t	Medicago arabica (L.) Hudson	.	.	.	.	+	+	+	.	.	.	.	1	+	.	.	.	.	.	1	2	+	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	9
			Cerastium semidecandrum variant																																					
T scap	EURASIAT.		Cerastium semidecandrum L.	.	.	.	.	.	+	.	.	.	2	1	1	+	1	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8
T scap	PALEOTEMP.		Trifolium campestre Schreber	.	.	.	.	.	.	.	+	.	.	1	+	2	1	.	.	.	.	.	.	2	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	8
T rept	COSMOP.		Stellaria media (L.) Vill.	.	.	.	.	.	.	.	.	.	1	1	+	+	+	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	7
			Bromus hordeaceus variant																																					
T scap	SUBCOSMOP.		Bromus hordeaceus L.	.	.	.	+	.	1	+	+	1	+	.	.	+	+	2	2	2	4	2	4	1	1	2	.	.	.	1	+	.	+	.	.	1	+	+	+	24
H caesp	CIRCUMBOR.		Poa pratensis L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	2	+	.	.	1	2	.	1	.	.	.	.	.	.	.	.	.	.	.	.	7
T scap	EURIMEDIT.		Bromus gussonei Parl.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	7
H scap	N-MEDIT.		Ranunculus velutinus Ten.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	2	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	5
T scap	MEDIT.ATL.(EURI)		Crepis vesicaria L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	3
			Verbena officinalis facies																																					
H scap	PALEOTEMP.		Verbena officinalis L.	.	.	.	.	+	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	1	1	+	+	.	+	+	1	+	3	15
T rept	COSMOP.		Polygonum aviculare L.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	.	+	.	.	+	+	.	.	.	.	7
T scap	SUBCOSMOP.		Setaria viridis (L.) Beauv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	.	.	.	.	4
T scap	EURIMEDIT.		Pallenis spinosa (L.) Cass.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+	.	3
T scap	SUBCOSMOP.		Echinochloa crus-galli (L.) Beauv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	3
			Characteristic species *Lolio perennis-Plantaginion majoris*, *Plantaginetalia majoris*, *Molinio-Arrhenatheretea*																																					
H rept	PALEOTEMP.		Trifolium repens L.	.	1	1	.	1	1	3	2	2	2	3	3	3	3	3	2	2	.	.	.	1	1	3	2	.	.	.	+	+	.	.	1	+	+	+	.	25
H caesp	EURASIAT.		Poa trivialis L.	1	2	1	2	2	2	1	1	1	2	+	1	1	1	1	+	1	2	1	1	3	.	.	1	.	.	.	+	.	.	+	.	.	.	.	.	24
H ros	EURASIAT.		Plantago lanceolata L.	.	.	.	+	1	1	1	.	+	.	2	+	+	+	2	1	1	1	1	1	1	3	2	1	.	.	.	2	2	2	+	.	.	.	+	.	24
H ros	EUROP.-CAUC.		Bellis perennis L.	.	+	+	.	1	1	1	+	.	1	3	1	1	2	.	.	+	1	1	+	1	2	3	+	.	.	.	.	.	.	.	.	.	1	1	+	22
H ros	PALEOTEMP.		Potentilla reptans L.	.	+	.	.	1	+	1	.	2	+	.	2	1	2	.	.	.	+	.	.	+	1	+	.	.	.	.	+	.	.	+	1	.	.	.	.	16
H caesp	PALEOTEMP.		Dactylis glomerata L.	1	+	+	1	1	1	+	1	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	+	.	+	.	2	1	.	16
H scap	SUBCOSMOP.		Rumex crispus L.	.	.	+	.	.	.	.	+	+	.	.	.	.	.	.	.	.	1	.	.	.	.	1	+	.	.	+	+	+	.	1	.	.	.	.	.	10
H scap	EURASIAT.		Rumex conglomeratus Murray	1	+	+	+	.	.	+	.	+	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8
H scap	EURIMEDIT.		Pulicaria dysenterica (L.) Bernh.	.	.	+	.	.	.	.	1	.	+	.	3	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	8
H scap	EUROSIB.		Trifolium pratense L.	+	.	+	1	.	1	+	3	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7
T rept	PALEOTEMP.		Trifolium resupinatum L.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	+	.	.	.	+	1	.	.	.	7
H caesp	CIRCUMBOR.		Holcus lanatus L.	.	.	1	.	.	+	.	.	.	.	+	2	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6
H ros	CIRCUMBOR.		Taraxacum officinale Weber (aggregato)	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.	4
H scap	MEDIT.ATL.(EURI)		Oenanthe pimpinelloides L.	.	.	1	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
H scap	EUROP.		Centaurea nigrescens Willd. ssp. neapolitana (Boiss.) Dostal	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1

H scap	PALEOTEMP.	Epilobium tetragonum L.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
H caesp	PALEOTEMP.	Festuca arundinacea Schreber	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
H caesp	SUBTROP.	Hordeum bulbosum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
H bienn	EURIMEDIT.	Linum bienne Miller	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
H bienn	EUROSIB.	Pastinaca sativa L. ssp. urens (Req.) Celak	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
H scap	PALEOTEMP.	Mentha longifolia (L.) Hudson	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1
G rhiz	SUBCOSMOP.	Paspalum paspaloides (Michx.) Scribner	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	1
H rept	PALEOTEMP.	Ranunculus repens L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1
		Other species																																					
T caesp	COSMOP.	Poa annua L.	1	+	+	1	+	+	+	+	.	+	1	+	+	+	+	+	1	+	+	+	.	+	1	1	.	.	.	+	.	.	.	+	1	.	.	.	25
T scap	EURASIAT.	Geranium dissectum L.	+	+	+	+	+	+	+	.	.	+	.	+	1	1	+	+	+	1	+	1	+	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	20
T scap	EURIMEDIT.	Hordeum murinum ssp. leporinum (Link) Arcang.	+	+	.	1	1	1	+	.	1	+	.	.	.	.	1	1	+	2	+	+	.	+	.	.	2	2	.	+	+	.	+	.	.	.	.	.	20
T scap	AVV.	Veronica persica Poiret	.	.	.	+	1	+	+	.	.	1	1	.	.	+	+	+	+	+	+	+	.	+	1	+	.	.	.	.	.	.	+	+	.	.	.	.	18
T scap	EURIMEDIT.	Picris echioides L.	.	.	+	+	+	.	+	.	1	1	.	.	1	+	.	.	.	.	.	.	.	.	.	+	+	.	+	+	1	+	1	+	.	+	+	.	18
H scap	PALEOTEMP.	Cichorium intybus L.	.	.	.	.	.	.	.	+	1	.	+	.	+	+	2	1	+	.	1	+	.	+	1	1	.	.	.	+	1	1	+	.	.	.	.	.	17
H bienn	PALEOTEMP.	Daucus carota L.	.	.	.	+	+	+	+	+	.	.	.	.	.	.	+	+	.	+	.	.	.	+	+	.	.	.	.	.	+	1	1	.	.	.	+	1	15
T scap	PALEOTEMP.	Medicago lupulina L.	.	.	.	+	+	+	+	.	.	.	.	1	1	+	1	1	.	.	.	.	.	+	1	1	.	.	.	.	.	.	.	.	.	.	+	.	13
T scap	EURASIAT.	Avena fatua L.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	+	.	.	1	+	.	.	+	+	.	+	+	+	+	.	.	.	.	+	12
T scap	MEDIT.-TURAN.	Vicia sativa L.	.	.	+	+	.	.	.	1	.	.	.	+	+	+	+	+	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11
T scap	EURASIAT.	Sonchus asper (L.) Hill	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	+	+	+	.	+	.	+	.	.	+	.	.	+	+	+	.	.	.	.	11
T scap	PALEOTEMP.	Veronica arvensis L.	.	.	.	.	.	+	.	.	.	.	+	1	+	+	.	.	+	.	+	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10
T caesp	SUBCOSMOP.	Lophochloa cristata (L.) Hyl.	.	.	.	+	+	+	+	.	.	.	.	+	+	+	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	+	.	.	.	10
H bienn	PALEOTEMP.	Silene alba (Miller) Krause	+	+	.	.	+	+	+	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	9
T scap	EURIMEDIT.	Catapodium rigidum (L.) Hubbard	.	.	.	+	+	+	+	.	.	.	.	+	+	+	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8
H scap	EUROSIB.	Picris hieracioides L.	.	.	.	.	.	.	.	.	1	.	+	.	.	.	.	.	.	+	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	+	+	.	7
T scap	AVV.	Conyza canadensis (L.) Cronq.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	+	.	+	+	.	.	+	.	.	.	6
T scap	SUBCOSMOP.	Matricaria chamomilla L.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	+	.	+	+	1	.	.	.	6
H scap	EURASIAT.	Galium album Miller	.	.	.	.	1	1	+	.	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6
H scap	EUROSIB.	Malva sylvestris L.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	6
T scap	EURIMEDIT.	Avena barbata Potter	.	.	.	.	.	.	+	.	.	+	.	.	+	+	.	.	.	.	.	+	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	6
T scap	EURIMEDIT.	Sherardia arvensis L.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	1	1	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	6
H scap	CIRCUMBOR.	Prunella vulgaris L.	.	1	+	.	.	+	.	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
H scap	PALEOTEMP.	Cerastium arvense L.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	+	.	+	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	5
T scap	EURIMEDIT.	Medicago hispida Gaertner	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	1	.	2	.	.	.	.	.	.	.	.	.	1	.	.	.	5
H scap	CIRCUMBOR.	Artemisia vulgaris L.	.	.	.	.	.	.	1	.	.	+	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	5
G rhiz	CIRCUMBOR.	Agropyron repens (L.) Beauv.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1	5
		Sporadic species	4	2	1	3	2	2	3	2	5	5	3	1	2	1	2	2	0	2	3	3	6	4	2	1	6	2	4	5	2	2	1	1	4	9	5	8	

higher disturbance conditions.

This facies, identified by the sequence of relevés 25 to 36, probably represents a transition aspect towards the vegetation types that belong to the *Polygono-Poetea* class, to which *Cynodon dactylon* and *Polygonum aviculare* are attribuited, within the alliance *Polygonion avicularis* (Oberdorfer, 1990).

Medicago hispidae-Vulpietum ligusticae ass. nova *vulpietosum ligusticae* subass. nova (Table 5, type rel. no. 6)

Vulpia ligustica is a Mediterranean caespitose therophyte species of the annual meadows. It is characterised by early spring flowering. In the study area, this species forms communities that are seen on very shallow and compacted clay-arenaceous or marly calcareous terrain. The *Vulpia ligustica* communities are characteristic of the road verges, where the soil is very compact because of the passage of trucks or other heavy vehicles. These vehicles tend to take up a large part of the road, and often end up with their wheels on the outer edges of the road. This results in a higher disturbance gradient.

This coenosis often grows on flat ground. It has never been detected where there are steep road banks, because it does not tolerate being in the shade that would be provided by the vegetation of the outer edge against the margin closest to the road. The *Vulpia ligustica* coenoses reach their maximum vigor in spring. They are characterised by a peculiar reddish colour at the beginning of May. They then usually dry up by the end of May. In some sites where these *Vulpia ligustica* coenoses have been detected, they are seriously threatened by the use of herbicides and by the reshaping of the road verges.

Along the roads of the study area was already detected the therophytic community *Aveno barbatae-Brometum diandri* (Biondi & Baldoni, 1991), while no communities characterised by the dominance of *Vulpia ligustica* has been described so far for central Italy. However, the association *Hordeo-Vulpietum ligusticae* (Brullo *et al*., 1995; Cirino & Longhitano, 1997) has been detected in Messina and its surroundings, in Sicily (Bartolo *et al*., 1988), and it has also been reported for the Liguria Region (Mariotti, 1995; *nome nudum*).

Our relevés differ from those attributable to this association, due to the lack of some thermophilous and strictly Mediterranean species, such as *Plantago lagopus* and *Crepis foetida*. This coenosis is also distinguished from *Hordeo-Vulpietum ligusticae* by the consistent presence of some mesophilous Eurimediterranean or paleotemperate species, such as *Medicago hispida* and *Veronica arvensis*.

Another association that is characterised by *Vulpia ligustica* is *Vulpio ligusticae-Tetragonolobetum biflori*. This was detected in Sicily, along road verges. It is referred to the alliance *Fedio-Convulvulion cupaniani*, to the order *Thero-Brometalia* and to the class *Stellarietea mediae* (Brullo & Spampinato, 1985; Brullo *et al*., 1995). However, our relevés cannot be linked to this syntaxon, due to clear floristic differencies that are detectable at the levels of association (*Tetragonolobus biflorus* and *Coleostephus myconis* are not present), alliance (because of the different phytogeographical meanings), and order.

The association *Vulpio ligusticae-Trisetarietum aureae* was also detected in Sicily (Cirino & Longhitano, 1997), and it grows in rocky locations that are characterised by minimal soil. It is referred to the alliance *Thero-Brachypodion ramosi*, to the order *Lygeo-Stipetalia* and to the class *Lygeo-Stipetea*. It is an ephemeral terophytic meadow and its diagnostic species are *V. ligustica*, *Trisetaria aurea*, *P. lagopus* and *Trifolium nigrescens* (Brullo *et al*., 1993). The lack of these latter three species, and of other entities attributable to the class *Lygeo-Stipetea*, leads us to also discard the hypothesis to assign our relevés to this association, which is characterised by greater thermophilous aspects.

The association *Cutandio-Vulpietum ligusticae* is instead ascribed to the alliance *Anthyllido-Malcomion lacerae*, to the order *Malcomietalia* and to the class *Tuberarietea guttatae*. It has been reported in some coastal localities of the Italian peninsula (Gehu *et al*., 1984). The clear ecological and floristic differences do not allow us to attribute our relevés to this association. The species *Vulpia ligustica* also characterises the alliance *Vulpion ligusticae*, which is related to the order *Tuberarietalia guttatae* and to the class *Tuberarietea guttatae* (Loisel, 1978; Rivas Martínez *et al*., 2002). This alliance is endemic of Provence (Loisel, 1978), and therefore it includes phytogeographically well distinguishable coenoses.

In accordance with these details, we propose the new association *Medicago hispidae-Vulpietum ligusticae*. This is assigned to the alliance *Sisymbrion officinalis*, which gathers together the ruderal annual coenoses of temperate Europe, to the order *Sisymbrietalia officinalis*, characteristic of synanthropic and urban habitats, and to the class *Stellarietea mediae*. In addition to the dominant species, the typus subassociation *vulpietosum ligusticae* is also characterised *Medicago hispida* and *Veronica arvensis*, which are almost always present, and which grow on trampled soils, and by *Scabiosa maritima*, a Mediterranean hemicryptophyte that is exclusive to this coenosis (Table 2). This latter species probably expresses the contact with more evolved coenoses. Among the other species, the therophytes that belong to the higher hierarchical levels are well represented, particularly *Bromus hordeaceus*, *Hordeum murinum* ssp. *leporinum*, *Cerastium glomeratum*, *Veronica*

Tab. 5 - *Medicago hispidae-Vulpietum ligusticae* ass. nova
vulpietosum ligusticae subass. nova
calaminthetosum nepetae subass. nova

		Relevé number (table 5)	1	2	3	4	5	6*	7	8	9	10	11	12⁺	13	14	15	16	17	18	19	Presences
		Altitude (m a.s.l.)	45	45	45	130	45	50	40	200	205	205	170	170	15	185	110	110	45	185	225	
		Aspect	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Slope (°)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		Cover (%)	100	100	100	80	100	100	100	100	90	90	100	100	80	100	100	100	100	100	100	
		Area (m²)	3	4	1	4	3	5	2	8	4	5	3	3	4	1	3	2	3	3	1	
		Characteristic and differential species *Medicago hispidae-Vulpietum ligusticae vulpietosum ligusticae*																				
T caesp	STENOMEDIT.	Vulpia ligustica (All.) Link	5	5	5	4	5	5	5	4	4	4	4	4	3	4	5	5	5	4	4	19
T scap	PALEOTEMP.	Veronica arvensis L.	+	1	1	1	1	+	.	+	1	1	+	+	+	+	+	+	+	+	1	18
T scap	EURIMEDIT.	Medicago hispida Gaertner	+	+	.	1	.	1	.	.	.	.	1	1	+	2	1	2	2	+	2	13
H bienn	STENOMEDIT.	Scabiosa maritima L.	.	.	.	.	.	.	.	.	1	1	+	1	.	.	+	+	+	.	.	7
		Differential species *calaminthetosum nepetae*																				
H scap	OROF. S-EUROP.	Calamintha nepeta (L.) Savi	.	.	.	+	.	.	.	.	.	.	1	+	.	+	.	1	.	+	+	7
T scap	EURASIAT.	Geranium molle L.	.	.	.	.	.	.	.	.	.	+	.	.	+	1	+	+	.	1	.	6
T scap	PALEOTEMP.	Medicago lupulina L.	.	.	.	.	.	.	.	.	.	.	+	+	2	+	.	.	.	+	+	6
T rept	EURIMEDIT.	Trifolium scabrum L.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	1	2	2	5
T scap	COSMOP.	Cardamine hirsuta L.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	.	+	.	.	4
T scap	COSMOP.	Euphorbia helioscopia L.	.	.	.	.	.	.	.	.	.	.	.	+	1	+	.	.	.	.	+	4
T scap	MEDIT.-TURAN.	Crepis sancta (L.) Babc.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	+	.	+	1	.	4
T scap	PALEOTEMP.	Trifolium campestre Schreber	.	.	.	.	.	.	.	.	.	.	3	3	1	.	.	.	.	.	.	3
		Characteristic species *Sisymbrion officinalis*, *Sisymbrietalia officinalis*																				
T scap	SUBCOSMOP.	Bromus hordeaceus L.	1	1	+	+	+	+	1	+	+	+	+	+	+	.	+	.	1	1	.	16
T scap	EURIMEDIT.	Hordeum murinum ssp. leporinum (Link) Arcang.	+	+	+	1	+	.	+	+	+	+	.	.	.	+	+	+	.	+	.	13
T scap	EURIMEDIT.	Bromus madritensis L.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
T caesp	SUBCOSMOP.	Lophochloa cristata (L.) Hyl.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	2
T scap	EURIMEDIT.	Bromus gussonei Parl.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	1
T scap	EURIMEDIT.	Catapodium rigidum (L.) Hubbard	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
		Characteristic species *Stellarietea mediae*																				
T scap	EURIMEDIT.	Cerastium glomeratum Thuill.	+	+	1	.	.	+	.	.	+	+	+	+	1	+	1	+	1	.	+	14
T scap	AVV.	Veronica persica Poiret	.	+	+	.	+	+	+	2	+	+	.	.	.	+	.	+	1	+	+	13
T scap	EURASIAT.	Geranium dissectum L.	.	+	1	.	1	1	2	1	+	+	.	.	1	.	1	1	1	.	.	12
T scap	EURIMEDIT.	Sherardia arvensis L.	.	.	.	.	.	+	.	1	1	+	2	1	+	1	.	.	+	+	1	11
T scap	EURIMEDIT.	Senecio vulgaris L.	.	.	.	.	+	.	.	.	+	+	.	.	+	.	.	+	+	.	.	6
T scap	MEDIT.-TURAN.	Vicia sativa L.	.	.	+	.	.	+	1	1	.	.	.	.	.	.	.	.	+	.	.	5
T scap	STENOMEDIT.	Erodium malacoides (L.) L'Hér.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	2
T scap	EURIMEDIT.	Avena barbata Potter	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	1
T scap	EURIMEDIT.	Capsella rubella Reuter	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1
T scap	EUROSIB.	Euphorbia peplus L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1
T scap	EURASIAT.	Lamium purpureum L.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
T scap	STENOMEDIT.	Lotus ornithopodioides L.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
T scap	SUBCOSMOP.	Matricaria chamomilla L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1
T scap	EURASIAT.	Sonchus asper (L.) Hill	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1
T rept	COSMOP.	Stellaria media (L.) Vill.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
		Characteristic species *Tuberarietea guttatae*																				
T scap	EURASIAT.	Cerastium semidecandrum L.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	2
T scap	STENOMEDIT.	Hypochoeris achyrophorus L.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	2
T scap	S-MEDIT.	Melilotus sulcata Desf.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	2
T scap	SUBCOSMOP.	Arenaria serpyllifolia L.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1
T scap	EUROP.-CAUC.	Myosotis ramosissima Rochel in Schultes	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	1
		Other species																				
T caesp	COSMOP.	Poa annua L.	1	1	1	1	.	1	1	+	+	+	1	2	1	2	+	+	1	+	+	18
H ros	EURASIAT.	Plantago lanceolata L.	.	+	.	.	1	1	+	+	+	1	1	+	1	1	1	1	.	+	+	15
H scap	PALEOTEMP.	Cichorium intybus L.	.	.	.	.	.	1	+	.	.	.	+	+	.	+	+	.	.	+	+	8
G rhiz	PALEOTEMP.	Convolvulus arvensis L.	.	.	.	.	+	+	+	+	.	.	.	.	+	.	+	+	+	.	.	8
H ros	PALEOTEMP.	Potentilla reptans L.	+	+	.	.	.	+	+	1	.	.	.	.	+	1	.	.	+	.	.	8
T scap	EURIMEDIT.	Medicago arabica (L.) Hudson	+	+	1	+	.	+	.	2	.	.	.	.	.	.	.	.	.	.	.	6
H bienn	PALEOTEMP.	Daucus carota L.	.	.	.	.	+	.	+	.	+	.	.	.	+	.	.	.	.	.	.	4
H scap	EUROSIB.	Picris hieracioides L.	.	.	.	.	+	.	.	.	.	.	+	+	+	.	.	.	.	.	.	4
H caesp	CIRCUMBOR.	Lolium perenne L.	.	.	.	.	.	.	+	+	+	+	.	.	.	.	.	.	.	.	.	4
H scap	EUROSIB.	Trifolium pratense L.	+	.	+	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	4
G rhiz	COSMOP.	Cynodon dactylon (L.) Pers.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	+	.	.	.	4
H ros	STENOMEDIT.	Hyoseris radiata L.	.	.	.	.	.	.	.	.	1	1	.	.	.	+	.	.	.	.	.	3
H scap	STENOMEDIT.	Reichardia picroides (L.) Roth	.	.	.	+	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	3
H scap	PALEOTEMP.	Sanguisorba minor Scop.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	+	.	.	3
H scap	EUROSIB.	Malva sylvestris L.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	+	2
H scap	EURASIAT.	Galium album Miller	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	2
H ros	EUROP.-CAUC.	Bellis perennis L.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	2
H rept	PALEOTEMP.	Trifolium repens L.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	2
T rept	PALEOTEMP.	Trifolium resupinatum L.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	1	2
T scap	EURIMEDIT.	Plantago coronopus L.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	2
H scap	CIRCUMBOR.	Artemisia vulgaris L.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1
Ch suffr	SW-MEDIT.-MONT.	Calendula suffruticosa Vahl	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1

T scap	MEDIT.-TURAN.	Calepina irregularis (Asso) Thell.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
G rhiz	MEDIT.-TURAN.	Cardaria draba (L.) Desv.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1
T scap	MEDIT.ATL.(EURI)	Crepis vesicaria L.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1
T scap	PALEOTEMP.	Geranium rotundifolium L.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1
H scap	EURASIAT.	Linaria vulgaris Miller	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1
H scap	EURASIAT.	Medicago sativa L.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1
T scap	EURIMEDIT.	Securigera securidaca (L.) Deg. et Dorfl.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1
T scap	STENOMEDIT.	Tordylium apulum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1
H scap	EUROP.-CAUC.	Galium verum L.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	1
H scap	PALEOTEMP.	Hypericum perforatum L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1
G bulb	EURIMEDIT.	Muscari atlanticum Boiss. et Reuter	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1
H scap	EURIMEDIT.	Urospermum dalechampii (L.) Schmidt	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
H caesp	PALEOTEMP.	Poa bulbosa L.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1
T scap	EURIMEDIT.	Sagina apetala Ard.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1

persica, *Geranium dissectum* and *Sherardia arvensis*. The quota of species of the class *Tuberarietea guttatae* is also important. In addition to the differential entities *V. ligustica* and *M. hispida*, this syntaxon is indeed represented by the sporadical presence of *Crepis sancta*, *Cerastium. semidecandrum*, *Hypochoeris achyrophorus*, *Melilotus sulcata*, *Arenaria serpyllifolia* and *Myosotis ramosissima*. This group of species differentiates this plant community (Table 2) as more xerophilous than the others that we included in this study.

CALAMINTHETOSUM NEPETAE SUBASS. NOVA (TABLE 5, TYPE REL. NO. 12)

The subassociation *calaminthetosum nepetae* is identified by the subunit which groups the sequence of relevés 11-19. This can be considered as the thermo-xerophilous aspect of the coenosis, and it has been detected on marly-calcareous soils. Among the diagnostic species, some characteristic elements of terrain that is arid for most of the year are well represented, like the perennial *Calamintha nepeta*, and the early flowering annuals *Geranium molle*, *Medicago lupulina*, *Trifolium scabrum*, *Cardamine hirsuta*, *Euphorbia helioscopia*, *Crepis sancta* and *Trifolium campestre*.

POETUM ANNUAE FELFÖLDI 1942 (TABLE 6)

The *Poa annua* communities can be seen in heavily trampled areas, at the sides of paved or unpaved roads, in lay-bys, and along the centre of the dirt roads. They have also been detected near car parks and buildings, inside towns and cities. These coenoses usually occupy linear surfaces, in which the ground coverage rarely reaches 100%. Their maximum vigor is in the late spring, and then they dry up.

The association *Poetum annuae*, which is considered by some authors as a subassociation of *Lolio-Plantaginetum* (Carni, 2005), has not been reported so far for the Marche Region, although it is probably one of the most common ruderal coenoses (Carni, 2005). This is probably due to the scarcity of specific studies related to the vegetation of the trampled habitats of the central Italian peninsula. The association *Poetum annuae* has instead been reported on several occasions for the Balkan peninsula; e.g. in a study of the trampled habitats of the Republic of Macedonia (Carni *et al*., 2002), in the Slovenian Region of Prekmurje (Carni, 2005), in relation to the synanthropic vegetation of Kranj (Silk & Kosir, 2006), and in the Region of the Vaii Sadului Basin, in Romania (Dragulescu, 1995). It has also been reported for central Europe (Gutte & Hilbig, 1975).

In this coenosis, *Poa annua* is accompained by other species belonging to the class *Polygono-Poetea* and its lower levels, such as *Polygonum aviculare*, *Cynodon dactylon*, *Sclerochloa dura*, *Coronopus squmatus*, *Polycarpon tetraphyllon* and *Sagina apetala*. All of these species are characterised by high resistance to soil compaction. This community is relatively widespread in the study area. *Hordeum murinum* ssp. *leporinum* and *Plantago major*, as well as several other therophyte species of the class *Stellarietea mediae*, are always present. These species are also very adaptable, and can survive in highly compacted terrain.

CERASTIUM GLOMERATUM VARIANT (Table 6)

The *Cerastium glomeratum* variant is characterised by *Cerastium glomeratum*, *Bromus hordeaceus* and *Bellis perennis*. It is highlighted by the subunit that gathers the relevés included in the sequences 8 to 11. It has mainly been detected in urban areas, on nitrified and relatively moist soils.

MEDICAGO HISPIDA VARIANT (TABLE 6)

The *Medicago hispida* variant is characterised by *Medicago hispida*, *Plantago lanceolata*, *Dactylis glomerata* and *Bromus gussonei*, and this has been observed in rural areas. It is poor in species of the higher hierarchical levels, which are partially replaced by some entities of the coenosis *Medicago hispidae-Vulpietum ligusticae* and *Lolio perennis-Plantaginetum majoris* (*Vulpia ligustica* and *Plantago major* are present among the diagnostic species, in addition to those already mentioned). This variant is identified by the subunit which groups relevés 12, 13 and 14.

Tab. 6 - *Poetum annuae* Felföldi 1942
Cerastium glomeratum variant
Medicago hispida variant

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	Presences
		Relevé number (table 6)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
		Altitude (m a.s.l.)	20	295	85	40	190	30	200	45	45	15	15	225	30	30	
		Aspect	-	-	NE	-	SW	-	-	-	-	-	-	-	-	-	
		Slope (°)	-	-	5	-	20	-	-	-	-	-	-	-	-	-	
		Cover (%)	90	70	70	80	60	80	50	100	100	100	100	60	70	90	
		Area (m²)	3	4	3	5	2	4	5	1	1	4	3	2	1	1	
		Characteristic species *Poetum annuae*															
T caesp	COSMOP.	Poa annua L.	4	4	3	3	3	3	3	5	5	4	5	2	3	4	14
		Cerastium glomeratum variant															
T scap	EURIMEDIT.	Cerastium glomeratum Thuill.	.	.	.	.	.	.	.	1	+	+	+	.	.	.	4
T scap	SUBCOSMOP.	Bromus hordeaceus L.	.	.	.	.	.	.	+	+	+	1	+	.	.	.	5
H ros	EUROP.-CAUC.	Bellis perennis L.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	2
		Medicago hispida variant															
T scap	EURIMEDIT.	Medicago hispida Gaertner	.	.	.	.	.	.	.	.	.	.	.	+	2	1	3
H ros	EURASIAT.	Plantago lanceolata L.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	2
H caesp	PALEOTEMP.	Dactylis glomerata L.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	2
T scap	EURIMEDIT.	Bromus gussonei Parl.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	2
		Characteristic species *Matricario-Polygonion avicularis*, *Polygono-Poetalia*, *Polygono-Poetea*															
T rept	COSMOP.	Polygonum aviculare L.	+	1	1	1	+	1	.	.	.	+	+	.	.	.	8
G rhiz	COSMOP.	Cynodon dactylon (L.) Pers.	1	.	2	2	1	1	.	.	.	1	+	.	.	.	7
T scap	EURIMEDIT.	Sclerochloa dura (L.) Beauv.	1	.	.	+	+	.	1	.	.	.	.	.	.	.	4
T rept	EURIMEDIT.	Coronopus squamatus (Forsskal) Asch.	+	.	.	.	.	.	1	.	.	.	.	.	.	.	2
T scap	EURIMEDIT.	Polycarpon tetraphyllum L.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1
T scap	EURIMEDIT.	Sagina apetala Ard.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
H caesp	SUBCOSMOP.	Sagina procumbens L.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	1
		Other species															
T scap	EURIMEDIT.	Hordeum murinum ssp. leporinum (Link) Arcang.	.	+	+	+	+	2	+	+	+	+	+	.	.	2	11
H ros	EURASIAT.	Plantago major L.	+	1	+	.	.	+	.	+	+	.	.	+	+	+	9
T scap	EURIMEDIT.	Medicago arabica (L.) Hudson	.	.	.	.	.	1	+	+	.	2	+	.	.	.	5
T scap	SUBCOSMOP.	Matricaria chamomilla L.	.	.	+	.	2	1	.	.	.	.	.	+	.	.	4
H caesp	CIRCUMBOR.	Lolium perenne L.	+	1	.	.	.	1	.	.	.	.	.	.	.	.	3
H bienn	COSMOP.	Capsella bursa pastoris (L.) Medicus	.	.	+	1	.	+	.	.	.	.	.	.	.	.	3
T rept	COSMOP.	Stellaria media (L.) Vill.	.	+	1	.	+	.	.	.	.	.	.	.	.	.	3
H scap	EUROSIB.	Malva sylvestris L.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	2
T scap	EURIMEDIT.	Capsella rubella Reuter	.	.	.	.	.	.	+	.	.	.	.	+	.	.	2
T scap	EURIMEDIT.	Sherardia arvensis L.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	2
T scap	AVV.	Veronica persica Poiret	.	+	.	.	+	.	.	.	.	.	.	.	.	.	2
T caesp	STENOMEDIT.	Vulpia ligustica (All.) Link	.	.	.	.	.	.	.	.	+	.	.	+	.	.	2
G rhiz	PALEOTEMP.	Convolvulus arvensis L.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1
H bienn	PALEOTEMP.	Silene alba (Miller) Krause	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1
T scap	S-EUROP.	Xanthium italicum Moretti	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1
H scap	SE-EUROP.	Achillea collina Becker	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1
H caesp	EURASIAT.	Poa trivialis L.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1
H rept	PALEOTEMP.	Trifolium repens L.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	1
T rept	PALEOTEMP.	Trifolium resupinatum L.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1
T scap	EURIMEDIT.	Ammi majus L.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1
T scap	PALEOTEMP.	Bromus tectorum L.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1
T scap	STENOMEDIT.	Erodium malacoides (L.) L'Hér.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	1
T scap	EURASIAT.	Geranium dissectum L.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1
T caesp	SUBCOSMOP.	Lophochloa cristata (L.) Hyl.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
T scap	MEDIT.-TURAN.	Crepis sancta (L.) Babc.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1

Coronopodo procumbentis-Sclerochloetum durae Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936 (Table 7)

This association is characterised by dominance of the grass *Sclerochloa dura*, and by a very low degree of ground coverage, as it usually does not reach 50% to 60%. It can be seen on the dirt roads, where the terrain is continually subjected to the disturbing actions of the tractortyres. The species that constitute this coenosis can grow due to specific ecological and morphological adaptations, such as the prostrate habitus, the high resistance of the vegetative and reproductive organs to crushing, and the ability to root and develop in soils that are characterised by very low porosity.

The association *Coronopodo procumbentis-Sclerochloetum durae* is assigned to the alliance *Sclerochloo-Coronopodion squamati*, which gathers the therophyte communities of the clayey compacted soils (Rivas Martínez, 1975), to the order *Polygono-Poetalia*,and to the class *Polygono-Poetea*. This last was established in 1975: the pioneer associations of the heavily trampled habitats were previously assigned by different authors to different classes (*Plantaginetea majoris*, *Chenopodietea*, *Stellarietea mediae*), according to various interpretations (Rivas Martínez, 1975). This plant community grows in the spring, on

Tab. 7 - *Coronopodo procumbentis-Sclerochloetum durae* Br.-Bl. In Br.-Bl., Gajewski, Wraber & Walas 1936
Matricaria chamomilla variant

		Relevé number (table 7)	1	2	3	4	5	6	7	8	Presences
		Altitude (m a.s.l.)	20	20	20	20	40	40	40	40	
		Aspect	-	-	-	-	-	-	-	-	
		Slope (°)	-	-	-	-	-	-	-	-	
		Cover (%)	60	30	60	25	70	60	40	50	
		Area (mq)	5	10	3	10	5	5	5	5	
		Characteristic species *Coronopodo procumbentis-Sclerochloetum durae*									
T scap	EURIMEDIT.	Sclerochloa dura (L.) Beauv.	3	2	2	1	2	1	2	1	8
T rept	EURIMEDIT.	Coronopus squamatus (Forsskal) Asch.	.	.	2	.	1	1	2	2	5
		Matricaria chamomilla variant									
T scap	SUBCOSMOP.	Matricaria chamomilla L.	.	.	.	+	3	3	+	1	5
H bienn	COSMOP.	Capsella bursa pastoris (L.) Medicus	.	.	.	.	+	1	+	+	4
T scap	COSMOP.	Cardamine hirsuta L.	.	.	.	.	1	+	+	+	4
H scap	PALEOTEMP.	Cerastium arvense L.	.	.	.	.	+	1	+	+	4
G rhiz	PALEOTEMP.	Convolvulus arvensis L.	.	.	.	.	1	1	+	+	4
T scap	AVV.	Veronica persica Poiret	.	.	.	.	+	+	+	+	4
		Characteristic species *Sclerochloo durae-Coronopodion squamati*, *Polygono-Poetalia*, *Polygono-Poetea*									
G rhiz	COSMOP.	Cynodon dactylon (L.) Pers.	1	+	1	+	+	+	+	+	8
T caesp	COSMOP.	Poa annua L.	2	1	1	1	+	+	1	+	8
T rept	COSMOP.	Polygonum aviculare L.	+	+	1	+	1	+	+	1	8
		Other species									
H caesp	CIRCUMBOR.	Lolium perenne L.	1	.	+	.	.	.	.	.	2
H ros	EURASIAT.	Plantago major L.	.	.	+	+	.	.	.	.	2
H scap	PALEOTEMP.	Verbena officinalis L.	.	.	.	.	.	1	+	.	2
T scap	EURASIAT.	Veronica hederifolia L.	.	.	.	.	.	+	+	.	2
T scap	EURASIAT.	Geranium dissectum L.	.	.	.	.	.	.	+	.	1
T scap	EURIMEDIT.	Hordeum murinum ssp. leporinum (Link) Arcang.	1	.	.	.	.	.	.	.	1
T scap	EURIMEDIT.	Picris echioides L.	.	.	.	+	.	.	.	.	1
H scap	EURASIAT.	Ranunculus neapolitanus Ten.	.	.	.	+	.	.	.	.	1

intensively trampled soils (Diaz *et al.*, 1990). It reaches its peak development between late April and early May, and then it dries up by the beginning of summer. Reductions in the dirt road networks that connected the arable fields have undermined the conservation of this habitat. Indeed, in the study area, this coenosis can only be seen sporadically, associated with a few clayey dirt roads.

This coenosis has been observed in contact with other typical plant communities of the heavily trampled habitats. In the sub-coastal territory of the Marche Region, it was detected previously during a study of the vegetation of small ponds, called "*guazzi*", that are located near the Musone River mouth and not far from the present study area (Biondi *et al.*, 2002). This coenosis has also been reported in some studies that date back to the 1960s and that investigated the Balkan peninsula. Here it was indicated with the name *Sclerochloetum durae* (Trinajstic, 1964; Markovic-Gospodaric, 1969).

The species *Poa annua*, *Cynodon dactylon* and *Polygonum aviculare* are well represented in the association *Coronopodo procumbentis-Sclerochloetum durae*, in addition to the two diagnostic entities, *Sclerochloa dura* and *Coronopus squamatus*. The former species are characteristic of the higher hierarchical levels, and they are well adapted to withstand conditions of high stress induced by the passage of vehicles. The inclusion of other taxa is instead sporadic. However, among these species, the therophytes prevail.

Matricaria chamomilla variant (Table 7)

The *Matricaria chamomilla* variant is also characterised by these species, and also by *Capsella bursa-pastoris*, *Cardamine hirsuta*, *Cerastium arvense*, *Convolvulus arvensis* and *Veronica persica*. It has been detected along verges between the roads and the cultivated fields, which were located in the valley floor on sandy substrate. This variant is identified by the subset of relevés 5 to 8, and it develops under less severe soil compaction. This allows the entrance of some other annual synanthropic and ruderal species, which results in an increase in the floristic biodiversity value.

Syntaxonomic scheme

STELLARIETEA MEDIAE Tüxen, Lohmeyer & Preising ex von Rochow 1951

Sisymbrietalia officinalis J. Tüxen in Lohmeyer *et al.* 1962 em. Rivas-Martínez, Báscones, T.E. Díaz, Fernández-González & Loidi 1991

Sisymbrion officinalis Tüxen, Lohmeyer & Preising in Tüxen 1950
Medicago hispidae-Vulpietum ligusticae ass. nova (Table 5)
vulpietosum ligusticae subass. nova (Table 5)
calaminthetosum nepetae subass. nova (Table 5)
POLYGONO-POETEA Rivas-Martínez 1975
Polygono arenastri-Poetalia annuae Tüxen in Géhu, Richard & Tüxen 1972
Matricario-Polygonion avicularis Rivas-Martínez 1975
Poetum annuae Felföldi 1942 (Table 6)
Cerastium glomeratum variant (Table 6)
Medicago hispida variant (Table 6)
Sclerochloo durae-Coronopodion squamati Rivas-Martínez 1975
Coronopodo procumbentis-Sclerochloetum durae Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936 (Tab. 7)
Matricaria chamomilla variant (Table 7)
MOLINIO-ARRHENATHERETEA Tüxen 1937
Arrhenatheretalia elatioris Tuxen 1931
Ranunculo neapolitani-Arrhenatherion elatioris Allegrezza & Biondi 2011
Ranunculetum neapolitano-velutini ass. nova (Table 3)
Plantaginetalia majoris Tüxen & Preising in Tüxen 1950
Lolio-Plantaginion majoris Sissingh 1969
Lolio perennis-Plantaginetum majoris (Linkola 1921) Beger 1930 (Table 4)
cynodontetosum dactyloni subass. nova (Table 4)
Cerastium semidecandrum variant (Table 4)
Bromus hordeaceus variant (Table 4)
Verbena officinalis facies (Table 4)

Relationships between vegetation, land use and morphology

The vegetation of these mowed and trampled habitats is often arranged in spatial successions. This is due to variations that are related to the ecology, morphology and land use, which in these rural contexts can be relevant even in extremely restricted spaces. These spatial sequences have been identified through deep analysis of the small grassy surfaces that characterise the dirt roads and the vegetation strips that lie along them. The use of the floristic vegetational indices (Taffetani & Rismondo, 2009; Rismondo *et al*., 2011) allows the characterisation of each coenosis from the ecological point of view, and for comparisons to be made among these.

In the present study, we examined in particular the changes in the Index of Maturity (IM), the Index of Floristic Biodiversity (IFB), and the indices of the life forms (IT, IH, IF) for the six coenoses recorded (Table 1; Figs. 3, 4, 5). Our data show that the IM is higher for the coenoses that belong to the class *Molinio-Arrhenatheretea*, which grow in the relatively less trampled areas. The highest IM is reached by the association *Ranunculetum neapolitano-velutini* (3.77), which is mainly found in the farmhouse courtyards and sometimes along the outer edges of the roads, in flat, slightly depressed, fairly moist and regularly mowed areas. The coenosis *Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni* and its *Verbena officinalis* facies are characterised by slightly lower values of the IM (3.34 and 2.75, respectively). This is because they are more linked to trampling and to occasional mowing, to which the central bump and the outer edges of the dirt roads are subjected. Among these three vegetation types, the *Verbena officinalis* facies of *Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni* is the less mature, probably because it is favoured by the use of herbicides. The coenoses *Medicago hispidae-Vulpietum ligusticae*, *Poetum annuae* and *Coronopodo procumbentis-Sclerochloetum durae* are instead strictly related to surfaces that are subjected to continuous and intense disturbance. These develop on the inner edges of the roads and along the tyre tracks. These plant communities show the lowest values of the IM (2.32, 2.10 and 1.94, respectively) because they cannot evolve, due to the continuous anthropic disturbance.

These results are well correlated with the non-metric multidimensional statistical elaboration. Indeed, in Figure 2, the less mature coenoses are arranged to the extreme right of axis 1, while the more evolved are located to the left side of this axis.

The IFB is expressed as the number of species per relevé, and it shows a similar trend to that of the IM (Table 1). The coenoses that are favoured by mowing, such as the association *Ranunculetum neapolitano-velutini*, or by occasional mowing and slight or moderate

Plant community	IM	IFB	IT	IH	IF
RNV	3,77	25,37	17,78	78,69	3,54
LPPMc	3,34	25,17	25,66	68,11	6,23
LPPMcv	2,75	18,75	20,24	39,01	40,74
MHVL	2,32	17,37	87,13	12,51	0,36
PA	2,1	8,5	80,79	11,06	8,14
CPSD	1,94	9,25	82,1	9,1	8,8

Tab. 1 - Floristic-vegetational indices. For abbreviations, see legend to Figure 2 and main text.

trampling, like *Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni*, show the highest values of the IFB (25.37 and 25.17, respectively). Intermediate IFB values are seen for *Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni Verbena officinalis* facies (18.35) and *Medicago hispidae-Vulpietum ligusticae* (17.37), which have moderate to high resistance to trampling. The lowest IFB values are instead calculated for the pioneer coenoses that can develop on the highly trampled and compacted soils, such as *Coronopodo procumbentis-Sclerochloetum durae* (9.25) and *Poetum annuae* (8.50). Indeed, the vegetation communities that belong to the *Polygono-Poetea* class are mainly characterised by low species numbers, as only a few species can resist the intense crushing actions exerted by the continuous passage of vehicles. These species can survive even under these extreme ecological conditions because of their specific morphological adaptations.

For the indices of the life forms (Table 1), the therophyte coverage, as expressed by the IT, is particularly high in the coenoses of the classes *Stellarietea mediae* and *Polygono-Poetea*: *Medicago hispidae-Vulpietum ligusticae* (87.13%), *Coronopodo procumbentis-Sclerochloetum durae* (82.10%) and *Poetum annuae* (80.79%). The hemicryptophyte species dominate the syntaxa *Ranunculetum neapolitano-velutini* and *Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni*, which are characterised by the highest IH values (78.69% and 68.11%, respectively). Indeed, mowing favours the development of species with their vegetative reproduction organs located at ground level. *Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni Verbena officinalis* facies is characterised by a high IF value (40.74%), which expresses the coverage percentage of the perennial non-hemicryptophyte species. This is due to the almost absolute dominance of rhizomatous geophytes, like *Cynodon dactylon* and *Convolvulus arvensis*, the diffusion of which is probably favoured if the soil is periodically loose (this causes the fragmentation of the underground vegetative reproduction organs), and by the weeding of the hypogeal part of the vegetation.

An example of the vegetation sequence of a dirt road is illustrated in Figure 6. In this scheme, the coenoses are arranged according to the morphological features of the road. This comprises the central bump, which is almost always occupied by perennial vegetation, the tyre tracks, with their annual ephemeral vegetation, the verges, with therophyte vegetation, and the outer edges that are usually subjected to mowing, and which include the bump at the side and the gutter.

The perennial coenosis that is exposed to the highest degree of disturbance, the *Verbena officinalis* facies of *Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni*, was detected along the central bump of the road, while *Coronopodo procumbentis-Sclerochloetum durae* is the only association that can grow along the tyre tracks. The inner verges of the road are occupied by another coenosis, which belongs to the class *Polygono-Poetea*: the association *Poetum annuae*. On the outer verges, there is the thermo-xerophytic coenosis *Medicago hispidae-Vulpietum ligusticae*, which is slightly taller and less disturbed than those of the class *Polygono-Poetea*. The bumps at the side of the roads are characterised by the presence of the subassociation *Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni*. *Ranunculetum neapolitano-velutuni* is seen instead on the fairly moist and slightly depressed surfaces of the gutters.

Figure 6 illustrates the trends of the IM, and IFB along the vegetation transect. From this analysis, it is possible to highlight the increasing values of these two indices in passing from the heavy trampled to the regularly mowed habitats.

Discussion

In agroecosystems, it is sometimes possible to detect remarkable floristic richness and habitat diversity. This is due to the range of interactions that exist among the several disturbance regimes that can be found as a consequence of human activities. This is particularly evident in those situations in which the morphological and disturbance conditions clearly vary even over very small surfaces.

Along the best preserved dirt roads of the study area it was possible to detect vegetation communities belonging to three different syntaxonomic classes: *Stellarietea mediae*, *Polygono-Poetea* and *Molinio-Arrhenateretea*.

The coenoses of the class *Molinio-Arrhenatheretea*, as *Ranunculetum neapolitano-velutini*, *Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni* and its *Verbena officinalis* facies, are linked to both dirt roads and farmhouse courtyards. They are characterised by greater maturity and biodiversity. The highest maturity value has been detected for the first of these coenoses, which could be included in the Habitat

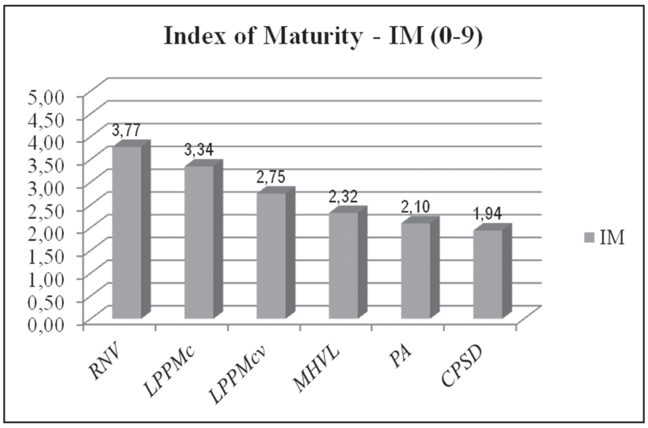

Fig. 3 - Comparison of the indexes of Maturity (IM=0-9) of the six coenoses. For abbreviations, see legend to Figure 2 and main text.

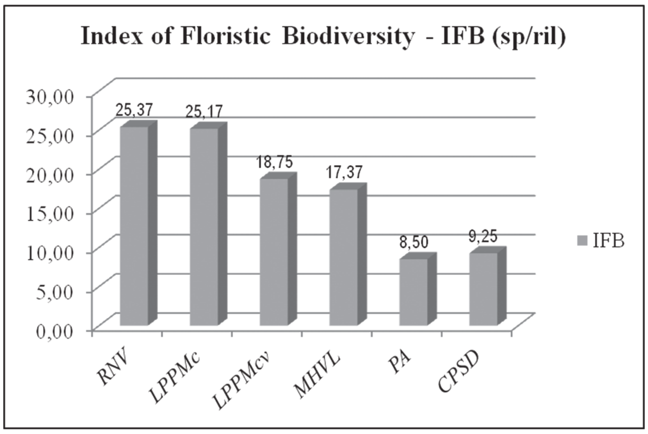

Fig. 4 - Comparison of the indexes of Floristic Biodiversity (IFB=species/relevé) of the six coenoses. For abbreviations, see legend to Figure 2 and main text.

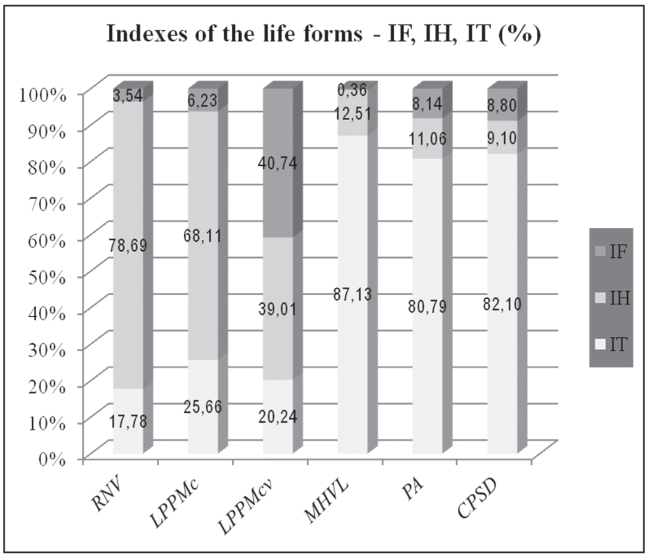

Fig. 5 - Comparison of the indexes of the life forms (IT, IH, IF=%) of the six coenoses. For abbreviations, see legend to Figure 2 and main text.

6510 (Lowland hay meadows) according to the Italian Interpretation Manual of the 92/43/EEC Directive Habitats. This vegetation type is favoured by periodic mowing and belongs to the order *Arrhenatheretalia elatioris*.

The therophytic coenosis of the class *Stellarietea mediae*, as *Medicago hispidae-Vulpietum ligusticae*, and those of the class *Polygono-Poetea*, as *Poetum annuae* and *Coronopodo procumbentis-Sclerochloetum durae*, are instead strictly linked to the habitat of the dirt roads. They are characterised by lower maturity and by a poor floristic level. This is particularly clear for the coenoses belonging to the class *Polygono-Poetea*, where there was an average of less than ten species for relevé.

The hemicryptophytic species clearly prevail in the association *Ranunculetum neapolitano-velutini*, which isregularly mowed. The therophytic species dominate the coenoses that grow on shallow, arid soils that are characterised by high anthropic disturbance and trampling. In *Lolio perennis-Plantaginetum majoris cynodontetosum dactyloni Verbena officinalis* facies, it was possible to detect the prevalence of geophyte species, particularly those stoloniferous. These are favoured by occasional disturbance, among which there is recurrent chemical weeding.

In the study area, the vegetation of these mowed and trampled habitats is severely threatened by the intensive agricultural land use. Indeed, the dirt roads for the connection of the cultivated fields are heavily impinged upon, to obtain more arable land and to make tillage easier. The vegetation of the farmhouse courtyards is instead threatened by the abandonment of the traditional agro-pastoral activities, and the consequent renovation of some farmhouses and their sorroundings. A further threat is seen from weeding, which is now widely practiced even outside of the cultivated areas.

The risks associated with the extreme simplification of the rural landscape and to the damage to some habitats can be identified with the irreversible loss of biodiversity and with the disappearance of certain phytocoenoses, and especially those characterised by high floristic richness.

Protection of the residual agrobiodiversity must be planned and pursued through specific actions. These should be aimed at the conservation and restoration of the vegetation types. The achievement of this objective requires the active participation of the farmers who live and work in these rural contexts, along with the establishment of greater environmental awareness within the population. The same population should be informed about the risks that are related to the methods of industrial agriculture, which invariably lead to the consumption of the natural resources. These practices also connect agricultural production to external input,

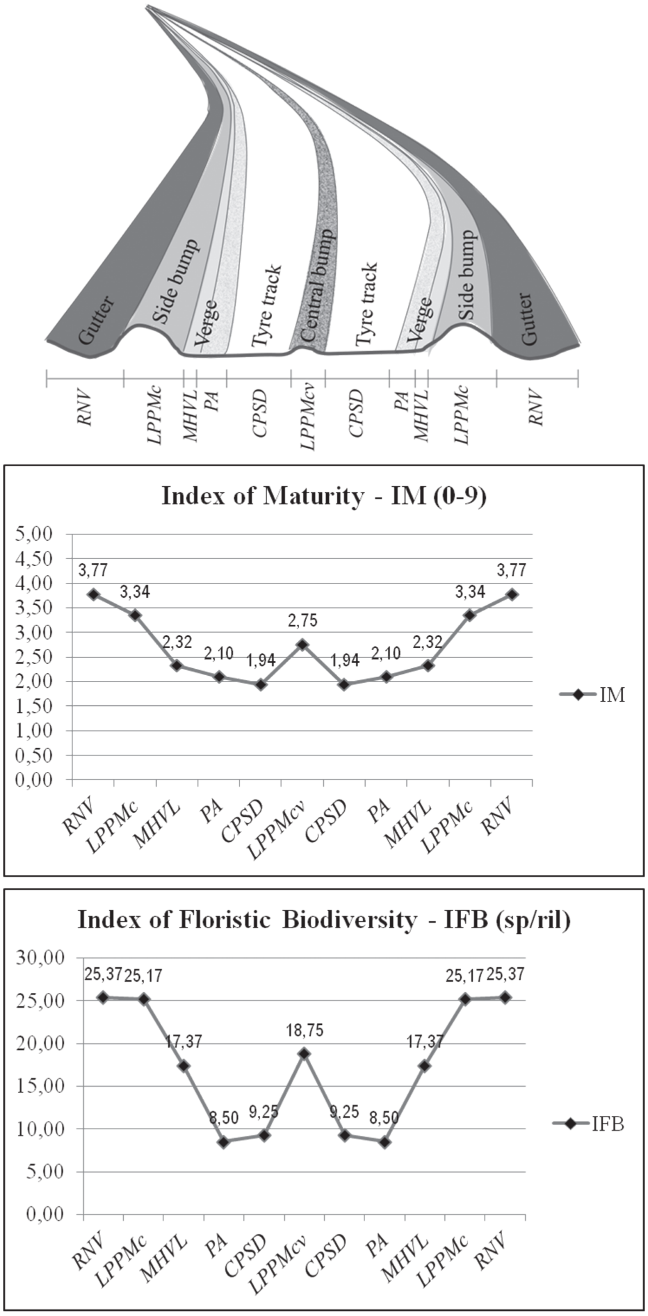

Fig. 6 - Vegetation succession of a dirt road, illustrating the relationships among the coenoses, the land use and the morphology. For abbreviations, see legend to Figure 2 and main text.

in an inextricable way, which are characterised by high energy costs.

As the laws concerning agrobiodiversity conservation mainly affect the farmers, they need to be better informed so that they can understand the need and urgence of actions that are aimed at the preservation of the residual natural heritage, to which productivity and improvement of the rural territories are strictly linked.

With regard to the specific normatives concerning the conservation of the rural landscapes, we suggest some changes in terms of their application in the study area, including:

a) The inclusion of the habitats related to dirt roads and farmhouse courtyards among those to be managed and preserved through periodic mowing, according to the cross-compliance rules.

b) The introduction of the restoration of all the treated habitats among the agro-environmental measures. These measures are included in the second Axis of the Rural Development Programmes.

The conservation of agrobiodiversity should be planned on the basis of the results derived from studies concerning the floristic composition, ecology and functionality of the phytocoenosis found in these rural contexts (Prach & Pysek, 2001; Bokenstrandt *et al*., 2004; De Cauwer *et al*., 2005; Buchwald *et al*., 2007). With the present study, we provide information that can be used for the application and testing of specific actions that are aimed at protecting and restoring the biodiversity. However, restoring this biodiversity cannot be separated from the recovery and reproduction of autochthonous germoplasm, nor from the necessary experimental testing aimed at the renaturalisation of such habitats.

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Appendix 1: Dates and locations of relevés

Table 2:
Rels. 1, 2, 8: 30/03/2010, Camerano (AN). Rels. 3, 24: 04/04/2010, Camerano (AN). Rels. 4, 5: 03/05/2010, Cingoli (MC). Rels. 6, 7: 22/04/2011, Appignano (MC). Rel. 9: 10/04/2010, Camerano (AN). Rels. 10, 11: 16/04/2010, Ancona. Rels. 12: 21/04/2010 Macerata. Rels. 13, 18: 21/04/2010, Appignano (MC). Rels. 14, 15, 16: 07/04/2010, Filottrano (AN). Rels. 17, 21, 27: 21/04/2010, Filottrano (AN). Rels. 19, 20: 03/05/2010, Appignano (MC). Rels. 22, 23: 08/04/2011, Osimo (AN). Rel. 25: 06/04/2010, Ancona. Rel 26: 08/04/2010, Osimo (AN).

Table 3:
Rels. 1, 2: 14/05/2010, Recanati (MC). Rels. 3, 8: 01/06/2010, Ancona. Rel. 4: 17/05/2010, Castelfidardo (AN). Rels. 5, 6, 7, 10: 18/05/2010, Ancona. Rel. 9: 15/06/2010, Ancona. Rels. 11, 22: 07/05/2010, Filottrano (AN). Rels. 12, 13, 14: 13/05/2010, Ancona. Rels. 15, 16: 03/05/2010, Appignano (MC). Rels. 17, 18: 21/04/2011, Osimo (AN). Rels. 19, 20, 21: 21/04/2011, Filottrano (AN). Rels. 23, 24: 08/04/2011, Osimo (AN).

Table 4:
Rels. 1, 2: 02/07/2009, Ancona. Rel. 3: 07/07/2009, Ancona. Rel. 4: 19/07/2011, Castelfidardo (AN). Rels. 5, 6, 7: 19/07/2011, Osimo (AN). Rel. 8: 02/07/2011, Castelfidardo (AN). Rel. 9: 12/06/2010, Appignano (MC). Rels. 10, 11, 12: 28/07/2009, Offagna (AN).

Table 5:
Rels. 1, 2: 13/04/2010, Ancona. Rels. 3, 5, 14, 18, 19: 14/04/2010, Ancona. Rel. 4: 26/04/2010, Ancona. Rels. 6, 17: 16/04/2010, Ancona. Rel. 7: 16/04/2010, Camerano (AN). Rel. 8: 21/04/2011, Filottrano (AN). Rels. 9, 10: 19/04/2010: Ancona. Rels. 11, 12: 14/04/2010, Sirolo (AN). Rel. 13: 17/04/2010, Castelfidardo (AN). Rels. 15, 16: 14/04/2010, Camerano (AN).

Table 6:
Rels. 1, 3: 10/05/2010, Castelfidardo (AN). Rels. 2, 5: 12/05/2010, Osimo (AN). Rel. 4: 14/05/2010, Osimo (AN). Rel. 6: 14/05/2010, Recanati (MC). Rel. 7: 21/04/2011, Filottrano (AN). Rels. 8, 9, 10, 11: 14/04/2010, Ancona. Rel. 12: 20/04/2010, Ancona. Rels. 13, 14: 28/04/2010, Recanati (MC).

Table 7:
Rels. 1, 3: 10/05/2010, Castelfidardo (AN). Rels. 2, 4: 17/05/2010, Castelfidardo (AN). Rels. 5, 6, 7, 8: 08/04/2011, Osimo (AN).

Appendix 2: Sporadic species

Table 3:
Rel. 1: *Cirsium arvense* (L.) Scop. (+), *Ranunculus ficaria* L. (+). Rel. 3: *Agrimonia eupatoria* L. (+). Rel. 4: *Lamium maculatum* L. (+), *Veronica chamaedrys* L. (1), *Cerastium semidecandrum* L. (+), *Vulpia ligustica* (All.) Link (+). Rel. 5: *Lamium maculatum* L. (+), *Veronica chamaedrys* L. (1), *Cerastium semidecandrum* L. (+), *Vulpia ligustica* (All.) Link (+). Rel. 6: *Euphorbia cyparissias* L. (+), *Cardamine hirsuta* L. (+). Rel. 9: *Anemone hortensis* L. (+), *Veronica hederifolia* L. (+). Rel. 10: *Stellaria media* (L.) Vill. (+),

Smyrnium olusatrum L. (+), *Vinca major* L. (+). Rel. 11: *Stellaria media* (L.) Vill. (+), *Sanguisorba minor* Scop. (+). Rel. 12: *Agrimonia eupatoria* L. (+), *Galium verum* L. (2), *Bromus erectus* Hudson (+), *Lotus ornithopodioides* L. (+). Rel. 13: *Brachypodium rupestre* (Host) R. et S. (1), *Galium verum* L. (1). Rel. 14: *Cirsium arvense* (L.) Scop. (+), *Sinapis alba* L. (+). Rel. 19: *Cirsium arvense* (L.) Scop. (+), *Prunella vulgaris* L. (1). Rel. 20: *Prunella vulgaris* L. (+), *Galega officinalis* L. (+). Rel. 21: *Cirsium arvense* (L.) Scop. (+). Rel. 22: *Cerastium arvense* L. (+), *Cynodon dactylon* (L.) Pers. (+), *Poa annua* L. (+). Rel. 23: *Stellaria media* (L.) Vill. (+), *Cerastium arvense* L. (+), *Cynodon dactylon* (L.) Pers. (+), *Poa annua* L. (+). Rel. 24: *Agrimonia eupatoria* L. (+), *Melissa romana* Miller (1). Rel. 26: *Stellaria media* (L.) Vill. (+), *Stachys sylvatica* L. (+). Rel. 27: *Brachypodium rupestre* (Host) R. et S. (+), *Stachys sylvatica* L. (+), *Glechoma hirsuta* W. et K. (+).

Table 4:

Rel. 1: *Capsella bursa pastoris* (L.) Medicus (+), *Carduus pycnocephalus* L. (+), *Polygonum aviculare* L. (+), *Erodium malacoides* (L.) L'Hér. (+). Rel. 2: *Capsella bursa pastoris* (L.) Medicus (+), *Polygonum aviculare* L. (+). Rel. 3: *Melissa romana* Miller (+). Rel. 4: *Euphorbia helioscopia* L. (+), *Xanthium italicum* Moretti (+), *Sclerochloa dura* (L.) Beauv. (+). Rel. 5: *Geranium rotundifolium* L. (+), *Achillea collina* Becker (+). Rel. 6: *Geranium rotundifolium* L. (+), *Achillea collina* Becker (+). Rel. 7: *Geranium rotundifolium* L. (+), *Galium aparine* L. (+), *Cruciata laevipes* Opiz (1). Rel. 8: *Bromus madritensis* L. (+), *Juncus bufonius* L. (+). Rel. 9: *Aster squamatus* (Sprengel) Hieron. (+), *Melissa romana* Miller (+), *Beta vulgaris* L. (+), *Calystegia sepium* (L.) R.Br. (+), *Lolium multiflorum* Lam. (1). Rel. 10: *Galium aparine* L. (+), *Cirsium vulgare* (Savi) Ten. (+), *Anagallis arvensis* L. (+), *Arundo donax* L. (+), *Rumex pulcher* L. (+). Rel. 11: *Carduus pycnocephalus* L. (+), *Alopecurus myosuroides* Hudson (+), *Ajuga reptans* L. (+). Rel. 12: *Vulpia ciliata* (Danth.) Link (+). Rel. 13: *Bromus tectorum* L. (+), *Vulpia ciliata* (Danth.) Link (+). Rel. 14: *Bromus tectorum* L. (+). Rel. 15: *Medicago sativa* L. (1), *Carex divulsa* Stockes (+). Rel. 16: *Medicago sativa* L. (1), *Carex divulsa* Stockes (1). Rel. 18: *Euphorbia helioscopia* L. (+), *Cruciata laevipes* Opiz (+). Rel. 19: *Euphorbia helioscopia* L. (+), *Vulpia ligustica* (All.) Link (+), *Coronopus squamatus* (Forsskal) Asch. (+). Rel. 20: *Euphorbia helioscopia* L. (+), *Carduus pycnocephalus* L. (+), *Galium aparine* L. (+). Rel. 21: *Bromus madritensis* L. (1), *Vulpia ligustica* (All.) Link (1), *Salvia verbenaca* L. (1), *Calamintha nepeta* (L.) Savi (1), *Geranium molle* L. (1), *Agrimonia eupatoria* L. (+). Rel. 22: *Geranium rotundifolium* L. (+), *Bromus madritensis* L. (3), *Lotus ornithopodioides* L. (+), *Myosotis arvensis* (L.) Hill (+). Rel. 23: *Capsella bursa pastoris* (L.) Medicus (+), *Cardamine hirsuta* L. (+). Rel. 24: *Capsella bursa pastoris* (L.) Medicus (+). Rel. 25: *Medicago sativa* L. (+), *Cirsium vulgare* (Savi) Ten. (+), *Erodium malacoides* (L.) L'Hér. (+), *Consolida regalis* S. F. Gray (+), *Anthemis cotula* L. (+), *Raphanus raphanistrum* L. (+). Rel. 26: *Anthemis cotula* L. (+), *Raphanus raphanistrum* L. (+). Rel. 27: *Aster squamatus* (Sprengel) Hieron. (+),*Calamintha nepeta* (L.) Savi (+), *Linaria vulgaris* Miller (+), *Filago pyramidata* L. (+). Rel. 28: *Medicago sativa* L. (+), *Chenopodium album* L. (+), *Setaria verticillata* (L.) Beauv. (+); *Hainardia cylindrica* (Willd.) Greuter. (+), *Ammi majus* L. (+). Rel. 29: *Amaranthus deflexus* L. (+), *Ammi majus* L. (+). Rel. 30: *Arctium minus* (Hill) Bernh. (+), *Cirsium arvense* (L.) Scop. (+). Rel. 31: *Ammi majus* L. (+). Rel. 32: *Portulaca oleracea* L. (+). Rel. 33: *Anagallis arvensis* L. (+), *Phalaris paradoxa* L. (1), *Hainardia cylindrica* (Willd.) Greuter. (2), *Lotus corniculatus* L. (+). Rel. 34: *Salvia verbenaca* L. (+), *Lotus corniculatus* L. (+), *Centaurium erythraea* Rafn (+), *Inula viscosa* (L.) Aiton (1), *Trifolium tomentosum* L. (1), *Cerastium glomeratum* Thuill. (+), *Trifolium echinatum* Bieb. (3), *Hedysarum coronarium* L. (1), *Galium verum* L. (+). Rel. 35: *Inula viscosa* (L.) Aiton (+), *Cerastium glomeratum* Thuill. (+), *Trifolium echinatum* Bieb. (2), *Hedysarum coronarium* L. (2), *Melilotus alba* Medicus (1). Rel. 36: *Bromus madritensis* L. (+), *Bromus tectorum* L. (+), *Aster squamatus* (Sprengel) Hieron. (+), *Inula viscosa* (L.) Aiton (1), *Cerastium glomeratum* Thuill. (+), *Galium verum* L. (+), *Torilis arvensis* (Hudson) Link (1), *Cirsium arvense* (L.) Scop. (+).