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THE ALLIANCE TRACHYNION DISTACHYAE RIVAS-MARTINEZ 1978 IN CENTRAL ITALY

FANELLI G.*, BIANCO P. M., DE SANCTIS M., SERAFINI SAULI A.

Dip.to di Biologia Vegetale, Sapienza Università di Roma, P.le Aldo Moro, 5 - 00185 Roma
** corresponding author: giuliano.fanelli@gmail.com*

ABSTRACT - The therophytic basiphilous vegetation of Central Italy has been generally framed in a single association *Trifolio scabri-Hypochoeridetum achyrophori* Biondi et al. 1997. We show that a considerable floristic variation exists inside *Trifolio-Hypochoeridetum* in Central Italy, and that it should be treated as a complex of no less than five different associations: *Medicagini rigidulae-Trifolietum scabri* Fanelli et al. hoc loco, *Trifolio scabri-Hypochoeridetum achyrophori* Biondi, Izco. Ballelli & Formica 1997 s.s, *Hippocrepido siliquosae-Brachypodietum distachyi* Fanelli et al. ad interim, *Trigonello gladiatae-Brachypodietum distachyi* Fanelli et al. hoc loc, *Crucianello latifoliae-Hypochoeridetum achyrophori* Filesi, Blasi, Di Marzio 1996. These associations are floristically and ecologically distinct, and show different geographical ranges in Central Italy. The great diversity of *Trachynion distachyae* in Central Italy is related to the widespread occurrence of limestone and calcareous alluvial rocks and to a climate with abundant winter and autumn rains very favourable to the development of winter annuals.

KEY WORDS - MEDITERRANEAN, NANOTHEROPHYTIC VEGETATION, SYNTAXONOMY.

INTRODUCTION

Nanotherophytic formations are widespread and diverse in Central Italy. Recently, an impulse to the study of this somewhat neglected vegetation has been given by the EU Habitat Directive. Habitat, that recognized as prioritary the habitat 6220 (* Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea*), including the different types of herbaceous dry vegetation of the Mediterranean. This vegetation is widespread on rocks rich in carbonates (limestone, but also clays, gravels, sands), but usually in small stands, often not larger than a few dm2, along paths, roads, or dispersed between the tufts of the tall monocots *Ampelodesmos mauritanica, Asphodelus microcarpus, Hyparrhenia hirta*. Nanoterophytic basiphilous vegetation occurs also frequently in heavily grazed pastures, usually in mosaic with dry grasslands (frequently referable to *Festuco-Brometea* Br.-Bl. et Tx. 1943 ex Klika et Hadac 1944), or in garigues and shrublands. Nanoterophytic communities occur on very thin, poor, not shuffled soils; on richer soils more demanding species rapidly predominate (*Euphorbia peplus, Sonchus oleraceus, Carduus pycnocephalus* etc., referable to *Hordeion leporini* Br.-Bl. (1931) 1947), whereas on shuffled soils the spreading of species referable to *Brometalia rubenti-tectorum* Rivas Martinez et Izco 1977 (*Aegilops geniculata, Tordylium apulum, Lotus ornithopodioides*) is observed. Nanoterophytic vegetation is dominated by small winter annuals not taller than 20-30 cm. They appear in winter, but usually bloom relatively late, in

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May or early June. There is a large year to year variability in the development of these communities: when rains are not abundant or drought begins earlier they become often not-apparent, whereas they bloom richly when spring rains are abundant. The floristic composition of nanotherophytic vegetation is often extremely rich and characteristic. *Leguminosae* are dominant, together with *Rubiaceae* and *Compositae*, rarely *Umbelliferae*, whereas *Gramineae* are rare.

The syntaxonomical and nomenclatural history of this vegetation is complicated. Braun-Blanquet et al. (1952) described a class *Thero-Brachypodietea* Br.-Bl. ex A. Bolos & Bolos in A. Bolos 1950 for herbaceous vegetation on basic soils, while communities of therophytes on acid soils were attributed to *Cisto-Lavanduletea* Br.-Bl. 1940, in the order *Helianthemetalia* Br.-Bl. in Br.-Bl., Molin. & H. Wagner 1940. *Helianthemetalia* were later erected to the class level, whereas *Thero-Brachypodietea* were emended and restricted to the nanoterophytic vegetation (Rivas-Martinez, 1977). A few authors (Rivas-Martinez, 1977) merge the classes *Helianthemetea* (Br.-Bl. ex Rivas-Goday, 1958) Rivas-Goday & Rivas-Martinez 1963 ad *Thero-Brachypodietea* in a single class *Helianthemetea guttatae* s.l., whereas other (De Foucault, 1999; Brullo et al. 2001) maintain them as distinct. Unfortunately, the name *Thero-Brachypodietea* has been applied both to the nanotherophytic and the perennial grassland vegetation resulting in great confusion. We prefer therefore to employ the names *Stipo-Trachynietea distachyae* Brullo 2001 and *Trachynion distachyae* Rivas-Martinez 1977 (Rodwell et al., 2002).

The synoptic table in De Foucault (1999) shows that Among *Stipo-Trachynetea* a clear phytogeographical distinction between Western and Central Mediterranean communities exists, related to higher rainfall in Central Mediterranean. De Foucault (1999) separates a group of communities centered in Southern France in the order *Brachypodietalia distachyae* Rivas-Martinez 1978, whereas more southern communities are referred to the order *Stipo-Bupleuretalia semicompositi* Brullo 2001. *Trachynion* is split into an alliance *Sideritidi romanae-Hypochoeridion achyrophori* De Foucault 1999, referred to *Stipo-Bupleuretalia*, and *Sideritidi romanae-Brachypodion distachyae* De Foucault 1999 = *Trachynion distachyae* s.s. in *Brachypodietalia distachyae*. *Stipo-Trachynetea* are relatively underexplored in Central and Eastern Mediterranean; it is therefore not possible here to discuss in detail the higher-level syntaxonomy of the class, and we will simply refer to *Trachynion distachyae* (=*Thero-Brachypodion*) as distinct from other alliances (*Onobrychido-Ptilostemion* Brullo 2001, *Plantagini-Catapodion* Brullo 1985, *Stipion retortae* Br.-Bl. In Br.-Bl. & O Bolos 1954, *Omphalodion brassicifolia* Rivas-Martinez, Izco & Costa 1973 etc.) typical of warmer and drier conditions. In Apulia a vegetation slighlty deviating from typical *Trachynion* has been described, referred to the suballiance *Ononinedion ornithopodioidis* Biondi & Guerra 2008, differentiated by a few thermophilous species (Biondi & Guerra, 2008).

In this paper we present the results of our investigation of *Trachynion distachyae* in Central Italy, where vegetation referred to this alliance is very diverse and more widespread than in the Western Mediterranean. Surprisingly, this large variability has not been generally recognized, and Central Italian *Trachynion* has been referred to a single association *Trifolio scabri-Hypochoeridetum achyrophori* Lapraz 1984 nom. inval. The question is if this variability is sufficient to distinguish different associations or not.

MATERIALS AND METHODS

In the years 1987-2007 112 relevés have been carried out in order to study the nanotherophytic vegetation on basic soils in Central Italy (Fig. 1). The study area encompasses in particular Latium, with emphasis on the Province of Rome, but relevés have been carried out also in other areas of Central and Southern Italy and in Western Greece as outgroups. To this set of relevés 58 relevés taken from the literature have been added, from Tuscany, Marche, Umbria and Latium, encompassing all published relevés from Italy referred to this vegetation known to us in the year 2008.

The environment of the study area is very diverse. Generally speaking, the climate is Mediterranean but with good rains in winter and spring and a summer drought usually not very strong. Rocks are very diverse; Trachynion occurs on limestone, gravels, sands, clays, and sometimes also on pyroclastites; in fact, volcanic rocks in Central Italy are rich in cations.

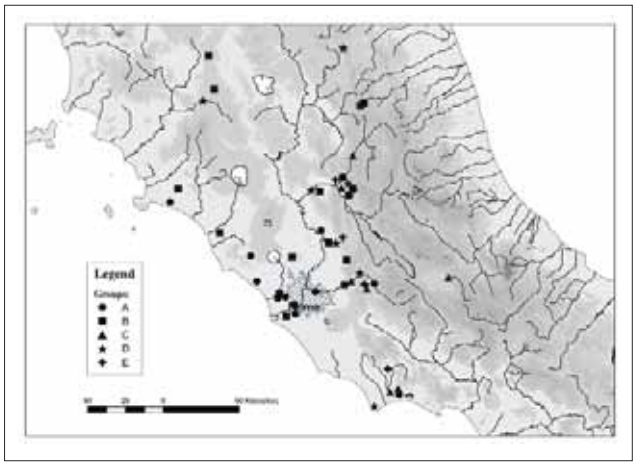

Fig. 1. Study area and the six groups of relevés identified. circles: group A., squares: group B; triangles: group C; stars: group D; crosses group E.

Relevés have been subjected to multivariate analysis with TWINSPAN program (Hill, 1997), and thereafter rearranged manually. An ordination has been carried out on the relevés by means of Detrended Correspondence Analysis with the package CANOCO, an ordination method where axes are constrained to be linear combination of species.

Average Ellenberg's indicator values (Ellenberg et al., 1992) have been calculated on the species groups resulting from the classification, not considering the very numerous companions, and relying on a database of values for the species in central Italy (Fanelli et al., 2006, 2007a). Here we define the ecological signature as the list of the six average indicator values (L T K F R N S) for a given species, group of species, relevé or community, and ecograph a diagram of two ecological indicator showing the relative position of two samples with respect of the ecological space.

Nomenclature follows Anzalone (1994, 1996).

RESULTS

Table of relevés comprises 623 species (Tab. enclosed). Many species are representative of *Festuco-Brometea* or *Rosmarinetea officinalis* Rivas-Martinez, Diaz, Prieto, Loidi, Penas 1991, or belong to *Koelerio-Corynephoretea* or *Stellarietea*; only a subset of the species are true basiphilous nanotherophytes. A number of relevés from the tables in Biondi et al. (1997), referred to *Trifolio scabri-Hypochoeridetum*, fall in a fully different group from the bulk of *Trachynion distachyae*, closer to *Koelerio-Corynephoretea* communities, and is not presented in Table 1.

When attention is concentrated only on species typical of *Stipo-Trachynetea distachyae*, different groups of species (A-E) appear.

Group A is represented by *Medicago truncatula, Hymenocarpus circinnatus, Medicago rigidula, Trifolium cherleri, Plantago lagopus, Melilotus sulcatus, Lotus edulis* and *Medicago littoralis*. *Trifolium cherleri* and *Plantago lagopus* occur also in many other communities, but here they reach their optimum. This group can be split in group A1 (*Melilotus sulcatus, Medicago truncatula, Lotus edulis*), and group A2 (*Plantago lagopus, Hymenocarpus circinnatus, Medicago rigidula, Trifolium cherleri, Medicago truncatula, Trifolium lappaceum*). Group A1 is more thermophilous and requires richer, more humid soils. This group of species occurs in warm areas along the coasts of Latium and southern Tuscany, in particular in the surroundings of Rome, but extends also inside on dry slopes. It occurs at 0-500 m. a.s.l. mainly on sands and clays of alluvial origin and on pockets of clays deriving from weathering of limestone.

Group B is represented by *Hedypnois rhagadioloides, Helianthemum salicifolium, Plantago bellardi, Euphorbia*

falcate, Euphorbia exigua, Ononis reclinata, Galium parisiense, Xeranthemum inapertum, Asterolinon linum-stellatum. These species prefer drier and colder conditions than group B. *Onobrychis caput-galli* occurs only in the relevés from the southern part of the area occupied by the community, whereas *Hippocrepis ciliata* (occurring also in group D) is represented only in the northern part of the area. This community occurs in southern Tuscany, Umbria, northern and central Latium, at 200-400 (800) m. a.s.l.. It occurs in an inner belt with respect to the community characterized by group A.

Group C is represented only by *Polygala monspeliaca, Althaea hirsuta* and *Hippocrepis unisiliquosa*. The community characterized by this group of species occurs in the Apennines (Umbria, Abruzzi, Latium) and in Southern Latium at 200-700 m. a.s.l.

Group D is represented by *Minuartia hybrida, Trigonella gladiata, Ononis pusilla*. This group of species occurs in the Apennines at quotes higher than group C (700-900 m), and in Southern Italy.

Group E is represented only by *Crucianella latifolia*. Sites of relevés diagnosed by this group are from Western Greece, and from Latium (Sabina on warm, southern slopes and Circeo), at 100-600 m. a.s.l.. It represents the warmest community.

A group of species (TB) is common to the whole table, although locally these species are more or less frequent: *Coronilla scorpioides, Scorpiurus muricatus, Trifolium stellatum, Crepis neglecta, Plantago afra, Trifolium scabrum, Hypochoeris achyrophorus, Sideritis romana, Medicago minima, Brachypodium distachyum, Linum strictum sl, Blackstonia perfoliata*. This set of species can be considered typical of *Trachynion distachyae*, although many of these species are rare in other parts of the Mediterranean. *Crepis neglecta*, for instance, is endemic to Italy and former Yougoslavia. This group almost perfectly overlaps with the character-species of *Stipo-Trachynetea distachyae* after the revision of De Foucault (1999). Many fragmentary relevés in the table present only this group of species, and lack differential character-species.

Among the companions, there are many transgressives of communities occurring in mosaic with *Trachynion distachyae*, mainly *Festuco-Brometea* (*Bromus erectus, Eryngium amethystinum, Petrorhagia saxifraga* etc.) or *Lygeo-Stipetea* Rivas-Martinez 1978. Abundant are the transgressives from *Brometalia rubenti-tectorum* (*Tordylium apulum, Medicago orbicularis, Catapodium rigidum, Aegilops geniculata* etc.), Species of *Helianthemetalia* are sparsely frequent in the table, pointing to the close relationship between *Stipo-Trachynetea* and *Helianthemetalia* (Rivas-Martinez, 1977).

Ordination

The first 3 axes of DCA explain 74% of variance of the dataset. Axis I suggests a successional gradient, whereas Axis II a gradient of acidity (Fig. 2), with less basic soils on the right and more basic soils on the left. Axis III (Fig. 3) follows a gradient of drought and temperature, with sites closer to the dryer northern coast of Latium on the negative side of the axis, and sites on hills and low mountains, with reduced summer drought and lower temperatures, on the positive side. The most interesting ordination is represented by axes II and III. On this plane, the five groups of relevés retrieved by structuring of the table are relatively well distinguished, although some overlap is detectable, in particular between group B and group C. Sites are ordered in skew belts that correspond with a gradient of summer drought. Group A, occurring on the northern coast of Latium, where rains are about 600-700 mm/year, is the driest; groups E and D are moister, occurring in Southern Latium, where summer drought are pronounced but annual precipitation are about 1200 mm/year).

Ellenberg's indicators

We calculated average indicator values only for the species of groups A-E and TB, because the large number of companions would confuse the pattern. The six groups of species are overall similar, although the ecological signature is different for each

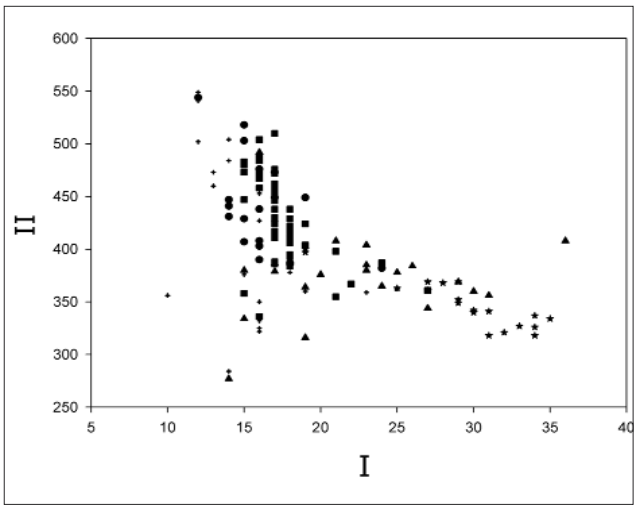

Fig. 2. DCA of axes II and III. Symbols as in Fig. 1.

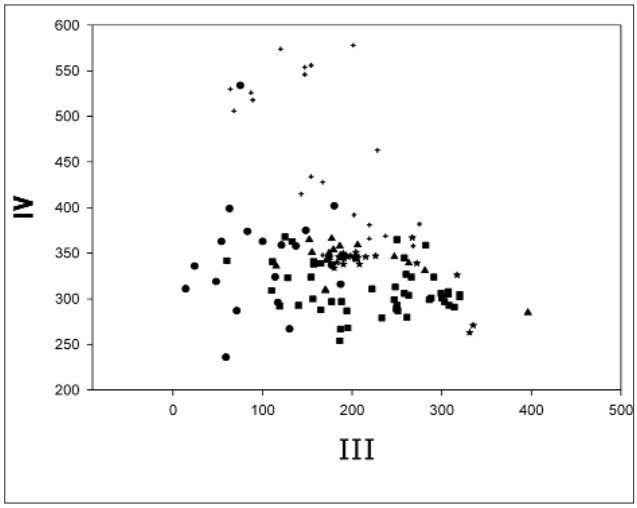

Fig. 3. DCA of axes III and IV. Symbols as in Fig. 1

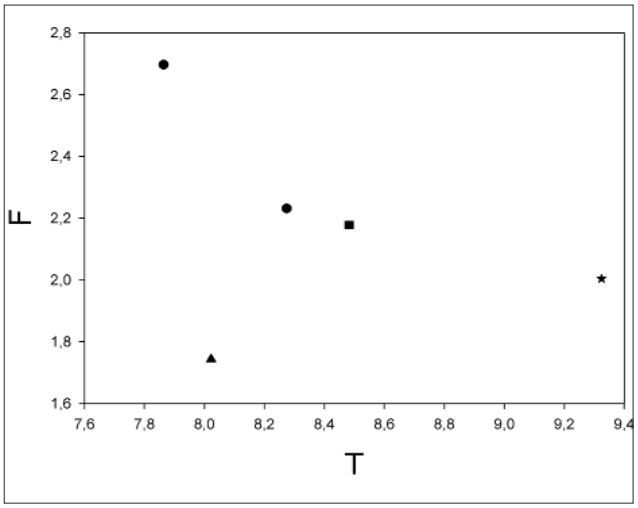

Fig. 4. Ecograph of Ellenberg's indicators F-T (humidity vs temperature). Symbols as in Fig. 1.

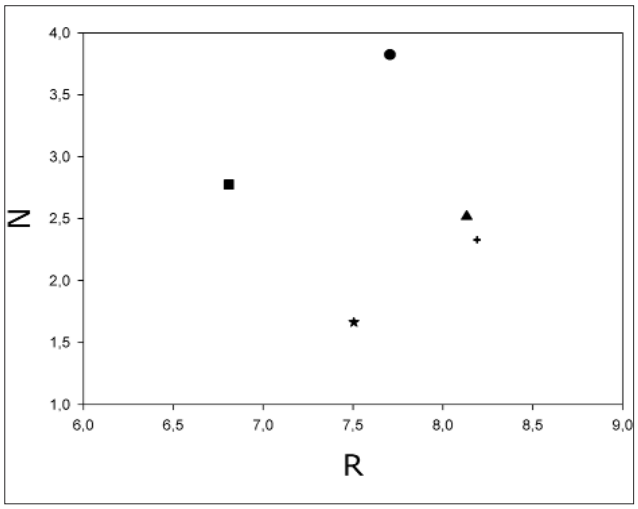

Fig. 5. Ecograph of Ellenberg's indicators N-R (nutrients vs reaction). Symbols as in Fig. 1.

group of relevés in at least an indicator. Two ecographs are particularly interesting, F-T and R-N. The ecograph F-T (Fig. 4) suggests a gradient from relatively wet, relatively cold conditions up to dry, warm conditions. The groups A, B, C, E follows this gradient; therefore, the communities here defined are distinct in particular along a climatic gradient. Group D is displaced and more xerophilous with respect to the other communities. The ecograph R-N (Fig. 5) shows TB in a central position, surrounded by the other groups of species. Ellenberg's indicators show that groups A and B are neutrophilous and grow on relatively rich soils, group D is slightly but distinctively basic, and grows on very poor soils, groups C and E are strongly basic and grow on poor soils. Interestingly, this latter ecograph allows, in woodlands, to distinguish humus forms (Ellenberg et al., 1992).

DISCUSSION

In Central Italy, therophytic basipihilous communities have been generally referred to *Trifolio scabri-Hy-*

pochoeridetum achyrophori Lapraz 1984 nom. inval. when legumes are abundant, or to *Saxifrago tridactylitis-Hornungietum petraeae* Izco 1974 and *Saxifrago tridactylitis-Hypochoeridetum achyrophori* Biondi et al. 1997, when *Saxifraga tridactylites*, *Erophila verna* etc. are dominant (Scoppola, 2000; Scoppola & Angiolini 2001; Biondi et al. 1997; Blasi et al., 1990). The latter are in our opinion better referred to *Koelerio-Corynephoretea* (Fanelli, 2007), although Mediterranean authors usually exclude therophytic communities from *Koelerio-Corynephoretea* (De Foucault, 1999; Rivas-Martinez et al., 1997). The former case is more complex. *Trifolio-Hypochoeridetum* was described only with a synoptic table (Lapraz, 1984), and is therefore not validly published. It was after validly published on the base of Italian relevés characterized by species of group B (Biondi et al., 1997). It is distinguished mainly by the abundance of group TB of table 1 (at the end of vol).

The question arises, if the five groups of species detected in this study differentiate sub-association of a very large *Trifolio-Hypochoeridetum*, or represent the character-species of distinct associations. Both approaches are tenable. Nonetheless, if we restrict to the nanotherophytic component, relevés from different groups of columns show little similarity (about 30%), suggesting that an analytical treatment should be preferred. Moreover, the associations occupy different geographical ranges. We therefore suggest to consider the different parts of Tab. 1 as distinct associations. Further study in the poorly explored Southern Apennines should be rewarding.

A drawback of a more analytical treatment is the fact that impoverished stands, lacking diagnostic species of groups A-E but well furnished with species of group TB should be treated as fragmentary stands, whereas they would be encompassed in a more comprehensive *Trifolio-Hypochoeridetum* s.l.. This can be annoying for cartography, but is useful in conservation, since it allows to distinguish typical stands with a saturated floristic composition, that occur only in relatively undisturbed condition and that should be the object of special conservation measures, from impoverished stands that should be also preserved, but whose conservation is less urgent. The latter are often very frequent and mistakenly rich in overall floristic composition, but can be detected because they lack the species of group A-E.

Medicagini rigidulae-Trifolietum scabri ass. nova hoc loco (group A)

(Typus Rel. 15)

This community, characterized by group A (Tab 1., rel. 1-19), is the most closely related to *Trifolio-Hypochoeridetum* of Southern France. Many species are in common (*Medicago truncatula, Medicago littoralis, Plantago lagopus, Medicago rigidula*), but *Hymenocarpus circinnatus* is lacking in Southern France and *Picris sprenglerana* and *Allium acutiflorum* are lacking in Italy (Lapraz, 1984).

The "Ass. ad *Asphodelus ramosus* e *Hymenocarpus circinnatus*" described from Rome (Fanelli, 2002) clearely belongs here.

The first few relevés (rel. 1-6) of Table 1 are characterized by subgroup A1 and the lack of *Medicago rigidula* and *Trifolium cherleri*, whereas *Melilotus sulcatus* is very frequent. They possibly represent a distinct community, typical of richer soil, but further research is needed on this topic.

This association occurs in Southern Tuscany and Latium in a coastal belt.

Trifolio scabri-Hypochoeridetum achyrophori Biondi, Izco. Ballelli & Formica 1997 (group B)

Relevés from Umbria, Marche, Tuscany, Northern Latium, present a rich group of differential species (*Helianthemum salicifolium, Galium parisiense*, etc.), belonging to group B. In Tivoli, near Rome, there is some overlap among this community and *Medicagini-Trifolietum*. Among the species of group TB a few (*Scorpiurus muricatus, Trifolium stellatum*) are frequent in *Medicagini-Trifolietum* but rare in *Trifolio-Hypochoeridetum*, whereas *Blackstonia perfoliata*, relatively rare in other communities, is frequent in *Trifolio-Hypochoeri-*

detum.

It should be stressed that many species of group B are often considered as class and alliance character-species in the treatment of *Stipo-Trachynietea* of authors from Spain and France (e.g. Bolos, 1962). These species are euriecious in Southern France and Spain, but in Central Italy they are restricted to this association.

The association is widespread in the provinces of Siena, Viterbo, Rieti, in the northern and central Province of Rome, and reaches Umbria.

Nowak (1987) presents a table doubtfully referred to this association for Eastern Ligury. This vegetation is very impoverished, and represents probably fragmentary disturbed stands that cannot be referred to any of the five associations presented here.

Hippocrepido siliquosae-Brachypodietum distachyii ad interim (Group C)

This community is characterized by the few species of group C. *Plantago lagopus*, transgressive from group A is relatively frequent. Species of group TB show here the strongest development. *Hippocrepis unisiliquosa*, although present in other communities of the Mediterranean, in Latium is very distinctive of warm, relatively humid conditions in spring. Nonetheless, we hesitate to describe this community as new, because it is possibly a subassociation of the following. Larger sampling of this and the following community, in particular in Campania and Basilicata is needed. The community is restricted to the Apennines in the supramediterranean belt.

Trigonello gladiatae-Brachypodietum distachyi nova hoc loco (Group D)

(Typus rel 108 in Tab. 1r, from Blasi et al., 1990, Tab 2 rel. 8)

This community is characterized by *Trigonella gladiata, Minuartia hybrida, Ononis pusilla* (group D) and is therefore well distinct. Among species of group TB, *Crepis neglecta* and *Trifolium stellatum* are frequent in this community, and otherwise rare or not frequent in the others. Species from groups A, B, C are lacking, whereas species from group TB are well represented. This community is restricted to relatively higher altitudes in the Subappenines and seems widespread on the Tyrrhenian side in Southern Italy. It deserves a closer look, because in Campania and Basilicata it is probably better developed than in Latium. Relevés 3 and 4 in tab. 13 in Maiorca & Spampinato (1999), from northern Calabria, should probably be referred here.

Crucianello latifoliae-Hypochoeridetum achyrophori Filesi, Blasi, Di Marzio 1996. (Group E)

This community is characterized only by *Crucianella latifolia*, and also species of group TB are poorly represented. This community has been retrieved in Southern Latium and in Western Greece, and seems an oriental community. It shows in fact some similarity in overall floristic composition with the Croatian *Trifolio-Brachypodietum rupestris* Horvatic 1958 (Horvatic 1958; Hecimovic 1984). Relevés from Ausoni mountains have been referred to this community (Di Pietro & Blasi, 2002). The table in this paper is floristically poor, and a clearcut classification is difficult. *Crucianella latifolia* is present only in rel.9.

Basal communities

Relevés 134-173 in Table 1 are rich in species from group TB but lack character-species of groups A-E. They are better treated, therefore, as basal communities (Kopecký & Hejný, 1978); a possible name is *Hypochoeris achyrophorus* (*Trachynion distachyae*) community. Rarely a dominant species appears, and in this case the namings *Medicago minima* (*Trachinion distachyae*) community, *Crepis neglecta* (*Trachynion distachyae*) community are possible.

CONCLUSIONS

Approximately at Nice the dry climate of Western Mediterranean is replaced by the wetter climate of Central Mediterranean, with more seasonal rains (Bolos, 1970). Moreover, limestones and generally basic soils are much more widespread eastwards. A

sharp floristic change occurs at this boundary, with the disappearance or rarefaction of many species, and the spread of species such as *Hypochoeris achyrophorus, Linum strictum*, many *Trifolium* and *Medicago* species. The alliance *Trachynion distachyae* diversifies and becomes very common. In fact, the analysis of a large number of original and literature relevés from Central Italy allows to split the very variable association *Trifolio scabri-Hypochoeridetum* achyrophori into several well defined communities. These communities are floristically, geographically and ecologically distinct. *Medicagini rigidulae-Trifolietum scabri* is the coldest and wettest community, with a preference for not very basic soils relatively rich in nutrients. It occurs along the coasts of Latium and Tuscany. *Trifolio-Hypochoeridetum* is more dry and warmer than the former, but occurs on similar soils. It is widespread in Tuscany, Umbria, Northern Latium, in a belt far from the sea. *Hippocrepido unisiliquose-Brachypodietum distachyi* occurs in dry and warm conditions, on poor, distinctively basic soils. It occurs in the Apennines and in the southern part of Latium in an inner belt. *Trigonello gladiate-Brachypodietum distachyi* occurs in dry and warm conditions, on very poor basic soils. It is widespread in the Apennines at higher quotes than *Hippocrepido-Brachypodietum* and is probably widespread in the Southern Apennines. Impoverished *Crucianello latifoliae-Hypochoeridetum achyrophori* occurs in very warm conditions in Southern Latium and Western Greece. Interestingly, the distribution of these five associations in Central Italy follows broadly NW-SE belts, closely reflecting the pattern of other vegetation types in the Province of Rome (Fanelli et al., 2007). Many stands, representing fragmentary *Trachynion* vegetation, cannot be referred to a definite association and are treated as basal communities.

In summary, the *Trachynion distachyae* is very diverse in Central Italy, with five co-occurring associations; this means that probably Central Italy represents a diversification centre of this vegetation in the whole Mediterranean, in part because of climate reasons, in part because limestone outcrop extensively in this region. Therefore, particular measures of protection should be addressed in this area to this and related vegetation types, taking care to preserve in particular the floristically saturated stands.

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Appendix 1: Sites of relevés and bibliographic references

R 1 : Tivoli (RM), olive grove, 3/6/99; R 2 : Platiri (Igoumenitsa), 11/5/02; R 3 : Rome, among Hyparrhenia hirta, 0/6/89; R 4 : Magliana (Rome), among Hyparrhenia hirta, 20/6/89 R 5 : Magliana (Rome), among Hyparrhenia hirta, 4/6/89; R 6 : Rome, among Hyparrhenia hirta, 4/6/89; R 7 : Agosta (RM), 3/6/93; R 8 : Castel di Guido (Rome); 29/5/93; R 9: M.te Tuscolo (RM), 10/6/93; R 10 : P.te Mammolo (Rome), on tuff, 2/5/92; R 11 : Fonte S. Stefano (Terracina, LT), 26/5/99; R 12 : Riserva Capalbio (GR), 31/5/92; R 13 : Aurelia, near Cerveteri (RM), 8/6/93; R 14 : S. Severa (RM), 8/6/93; R 15 : Rome, Cristoforo Colombo, 3/6/91; R 16 : Vitinia (Rome), among Hyparrhenia hirta, 8/6/91; R 17 : Malagrotta (Rome) 27/5792; R 18 : M.ti Ausoni (LT), 12/5/90; R 19 : Campo Soriano, M.te. Cetarella (LT), 12/6/90; R 20 : Close to Koutsochera (Greece), 5/5/02; R 21 : Riserva Caparbio (GR), 31/5/92; R 22 : Tivoli (RM), M.te Catillo, 30/5/05; R 23 : Tivoli (RM), M.te Catillo, 30/5/05; R 24 : Tivoli (RM), C.le Vescovo, 30/5/05; R 25 : Tivoli (RM), C.le Vescovo, 30/5/05; R 26 : Castel di Guido (Rome), 14/5/87; R 27

: Castel di Guido (Rome), 14/5/87; R 28 : Aurelia, Castel di Guido (Rome), 14/5/87; R 29 : Tivoli (RM), 17/4/88; R 30 : S. Antonio alla Macchia (S. Pancrazio Talentino, LC), 8/5/4; R 31 : Aurelia (RM), 14/5/87; R 32 : S. Nicola (Tremiti, FG), 17/5/92; R 33 : Colli sul Velino (RI), 21/6/97; R 34 : Fara Sabina (RM), 19/6/07; R 35 : Castel Porziano (Rome), Sughereto, 30/5/05; R 36 : Tivoli (RM), among Hyparrhenia hirta; 3/6/93; R 37 : Tivoli (RM), among Hyparrhenia hirta; 3/6/93; R 38 : Tivoli (RM), among Hyparrhenia hirta; 3/6/93; R 39 : Scoppola & Angiolini 2001, tab. 7, 8; R 40 : Scoppola & Angiolini 2001, tab.7, 6; R 41 : Scoppola & Angiolini 2001, tab. 9, 3; R 42 : Scoppola & Angiolini 2001, tab. 9, 5; R 43 : Scoppola & Angiolini 2001, tab. 9, 7; R 44 : Scoppola & Angiolini 2001, tab. 9, 8; R 45 : Scoppola & Angiolini 2001, tab. 9, 9; R 46 : Scoppola & Angiolini 2001, tab. 9; 6; R 47 : Scoppola & Angiolini 2001, tab. 9; 7; R 48 : Scoppola & Angiolini 2001, tab. 9, 8; R 49 : Scoppola & Angiolini 2001, tab. 9, 9; R 50 : Scoppola & Angiolini 2001, tab. 9, 10; R 51 : Scoppola & Angiolini 2001, tab.9, 11; R 52 : Scoppola & Angiolini 2001, tab.9, 12; R 53 : Scoppola & Angiolini 2001, tab.9, 13; R 54 : Scoppola & Angiolini 2001, tab.9, 14; R 55 : Scoppola & Angiolini 2001, tab.9, 15; R 56 : Scoppola & Angiolini 2001, tab.9, 16; R 57 : Scoppola & Angiolini 2001, tab.9, 17; R 58 : Biondi et al. 1997, tab. 3, 12; R 59 : Biondi et al. 1997, tab. 3, 13; R 60 : Biondi et al. 1997, tab. 3, 14; R 61 : Biondi et al. 1997, tab. 3, 7; R 62 : Fara Sabina (RM), Quattro Venti, 19/6/07; R 63 : Biondi et al. 1997, tab. 3, 8; R 64 : Campagnano (RM), M.te Razzano, on tuff, 15/5/99; R 65 : Campagnano (RM), M.te Razzano, on tuff, 15/5/99; R 66 : Campagnano (RM), M.te Razzano, on tuff, 15/5/99; R 67 : Campagnano (RM), M.te Razzano, on tuff, 19/5/99; R 68 : Biondi et al. 1997, tab. 3, 8; R 69 : Campagnano (RM), M.te Razzano, on tuff, 19/5/99; R 70 : Cerreto Laziale (RM), Mte Fossicchi, 19/5/00; R 71 : Cerreto Laziale (RM), Mte Fossicchi, 19/5/00; R 72 : Blasi et al. 1990 t 2, 11; R 73 : Caramanco, 5/6/88; R 74 : Riserva Caparbio (GR), 31/5/92; R 75 : Valle del Giovenco (AQ), 4/6/88; R 76 : M.t Ausoni (LT), clearing in the garigue, 125/90; R 77 : Tivoli (RM), 3/6/93; R 78 : M.t Bulgheria (SA), 1/5/93; R 79 : M.t Bulgheria (SA), 1/5/93; R 80 : Road to Campo Soriano (LT), 26/5/99; R 81 : Tivoli (RM), Mte Sterparo, 17/4/03; R 82 : Biondi et al. 1997, tab. 3, 9; R 83 : Biondi et al. 1997, tab. 3, 6; R 84 : Biondi et al. 1997, tab. 3, 7; R 85 : Blasi et al. 1990 t 2, 15; R 86 : Blasi et al. 1990 t 2, 21; R 87 : Blasi et al. 1990 t 2, 24; R 88 : Blasi et al. 1990 t 2, 17; R 89 : Blasi et al. 1990 t 2, 32; R. 90: Biondi et al. 2004 tab. 27, 4 R. 91: Biondi et al. 2004 tab. 27, 5 R. 92: Biondi et al. 2004 tab. 27, 6. R 93 : Blasi et al. 1990 t 2, 4; R 94 : Blasi et al. 1990 t 2, 2; R 95 : Blasi et al. 1990 t 2, 16; R 96 : Blasi et al. 1990 t 2, 5; R 97 : Blasi et al. 1990 t 2, 22; R 98 : Blasi et al. 1990 t 2, 23; R 99 : Blasi et al. 1990 t 2, 8; R 100 : Biondi et al. 1997, tab. 3, 9; R 101 : Biondi et al. 1997, tab. 3, 10; R 102 : Scoppola & Angiolini 2001, tab. 4, 4; R 103 : Scoppola & Angiolini 2001, tab. 4, 5; R 104 : Fara Sabina (RM), Quattro Venti, 25/4/03; R 105 : Blasi et al. 1990 t 2, 7; R 106 : Blasi et al. 1990 t 2, 16; R 107 : Blasi et al. 1990 t 2, 29; R 108 : Blasi et al. 1990 t 2, 8; R 109 : Rotale, Tazzina, 31/5/03; R 110 : Blasi et al. 1990 t 2, 14; R 111 : Blasi et al. 1990 t 2, 13; R 112 : Blasi et al. 1990 t 2, 9; R 113 : between S. Giovanni a Piro and Scario (SA), 1/5/93; R 114 : between S. Giovanni a Piro and Scario (SA), 1/5/93; R 115 : Cerreto Laziale (RM), Mte Fossicchi, 19/5/00; R 116 : Macchiagrande di Focene (RM), 8/4/2001; R 117 : Afroxilà (Nafpaktos), 7/5/02; R 118 : Afroxilà (Nafpaktos), 7/5/02; R 119 : Road to Makrino from Nafpaktos (Greece), 7/5/02; R 120 : Road to Makrino from Nafpaktos (Greece), 7/5/02; R 121 : Near Despotikò (Greece), among Hyparrhenia hirta,10/5/92; R 122 : Near Nafpaktos; 11/5/02; R 123 : Near Nafpaktos; 11/5/02; Montopoli Sabino (RI), 19/6/07: R 125 : Biondi et al. 1997, tab. 3, 11; R 126 : Filesi et al. 1996, tab. 4, ril 1 R 127 : Road to Makrino from Nafpaktos (Greece), 7/5/02; R 128 : Menadi (Greece), among Hyparrhenia hirta, 9/5/02; R 129 : Biondi et al. 1997, tab. 3, 3; R 130 : Biondi et al. 1997, tab. 3, 5; R 131 : Road to Makrino from Nafpaktos (Greece), 7/5/02; R 132 : Platiri (Igoumenitsa, Greece), 11/5/02; R 133 : Castel di Guido (Rome), among Asphodelus ramosus, R 134 : Cori (LT), Ponte dei Fraticelli, 1/6/95; R 135 : Cori (LT), Ponte dei Fraticelli, 1/6/95; R 136 : Campagnano (RM), M.te Razzano, on tuff, 15/5/99; R 137 : Province of Rome, 12/3/2; R 138 : Capranica Prenestina (RM), 23/6/05; R 139 : Sezze (LT), M.t Trevi, 7/5/94 R 140 : Palestrina (RM), I Colli, 23/605; R 141 : Blasi et al. 1990 t 2, 10; R 142 : S, Nicola (Tremiti, FG), 17/5/92; R 143 : Muratella (Rome), among Hyparrhenia hirta, 4/5/99; R 144 : Rome, 7/3/02; R 145 : Tivoli (RM), villa di Cassio, 11/6/95; R 146 : Tivoli (RM), villa di Cassio, 11/6/95; R 147 : Tivoli (RM), villa di Cassio, 11/6/95; R 148 : Tivoli (RM), M.te Catillo, 30/5/05; R 149 : S. Antonio alla Macchia (S. Pancrazio Talentino, LC), 8/5/4 R 150 : Pomezia (RM), 15/5/94; R 151 : Pico (FR), M.t Leucio, clearing in the maquis, 26/5/95; R 152 : Trevignano (RM), M.te Rinacceto, 27/4/02; R 153 : Tivoli (RM), M.te Catillo, 30/5/05; R 154 : M. Morra (Marcellina, Rm), 10/6/05; R 155 : M. Morra (Marcellina, RM), 10/6/05; R 156 : M. Morra (Marcellina, RM), 10/6/05; R 157 : Fara Sabina (RM), Quattro Venti, 19/6/07; R 158 : Pian della Faggeta (Lepini Mts, RM), 27/6/04; R 159 : Pian della Faggeta (Lepini Mts. RM), 27/6/04; R 160 : Rome, villa Torlonia, 9/5/3; R 161 : Tivoli (RM), Croce del Cavillo, 30/5/05; R 162 : Tivoli (RM), M.te Catillo, 30/5/05; R 163 : Giuliano di Roma (RM), 7/5/94; R 164 : Lago Fibreno (FR), Mola, rock wall, 11/7/06; R 165 : Fara Sabina (RM), 19/6/7; R 166 : Fara Sabina (RM), 19/6/7; R 167 : Fara Sabina (RM), Quattro Venti, 19/6/07; R 168 : Biondi et al. 1997, tab. 3, 15; R 169 : M.te Bulgheria (SA), 1/5/93; R 170 : M.te Bulgheria (SA), 1/5/93; R 171 : Cori (LT), Ponte dei Fraticelli, 1/6/95; R 172 : Tivoli (RM), C.le Vescovo, 30/5/05; R 173 : Cerreto Laziale (RM), M.te Fossicchi, 19/5/00;

Appendix 2: Sporadic species

R. 1: Trifolium resupinatum, Sinapis arvensis, Silybum marianum; R. 2: Cistus creticus subsp. creticus (r), Verbascum thapsus, Ulmus minor, Malope malacoides, Juniperus oxycedrus, Bellis perennis; R. 3: Herniaria hirsuta (r), Poa trivialis subsp. trivialis, Medicago murex, Linum viscosum, Euonymus europaea (pl), Diplotaxis tenuifolia, Cuscuta scandens subsp. cesatiana, Borago officinalis, Arum italicum; R. 4: Diplotaxis tenuifolia, Borago officinalis, Vicia villosa subsp. ambigua, Daphne gnidium; R. 5: Arum italicum, Medicago sativa, Ferula communis, Campanula rapunculus; R. 6: Epilobium tetragonum (r), Chrysanthemum segetum, Arum italicum, Poa trivialis subsp. trivialis, Vicia hybrida, Picris pauciflora, Ophrys apifera, Avena fatua, Agrimonia eupatoria; R. 7: Stachys cretica subsp. salviifolia, Conyza sumatrensis, Arabis irsuta, Alopecurus myosuroides; R. 8: Centaurea napifolia, Andryala integrifolia; R. 9: Anthoxanthum odoratum (r), Andryala integrifolia, Trifolium incarnatum subsp. molinieri (r), Prunus spinosa, Knautia integrifolia, Jasione montana, Festuca arundinacea, Echium italicum, Carex distans; R. 10: Verbascum thapsus, Trifolium suffocatum, Tolpis virgata, Senecio vulgaris, Reseda phyteuma, Orobanche minor, Lotus parviflorus, Hypochoeris radicata, Dactylis glomerata; R. 12: Sonchus asper, Cistus monspeliensis; R. 13: Ulmus minor (pl), Hedysarum coronarium, Allium ampeloprasum; R. 14: Malope malacoides, Ornithogalum narbonense, Hainardia cilindrica; R. 15: Silene conica; R. 16: Vicia hybrida, Diplotaxis tenuifolia, Borago officinalis, Malcolmia graeca subsp. bicolor, Erica multiflora; R. 17: Vicia hybrida (r), Chrysanthemum segetum (r), Phlomis fruticosa (r), Clematis vitalba (r), Borago officinalis, Ulmus minor (pl), Ferula communis, Ziziphora capitata; R. 18: Dactylis glomerata, Romulea columnae, Prunus spinosa (pl), Daucus carota; R. 19: Dactylis glomerata, Daucus carota, Silene italica subsp. nemoralis, Scandix pecten-veneris, Saxifraga tridactylites, Satureja vulgaris; R. 20: Tortula muralis, Silene colorata subsp. canescens, Lagurus ovatus, Cerastium illyricum, Asphodelus cerasifer; R. 21: Scorpiurus vermiculatus, Centaurium tenuiflorum, Allium subhirsutum; R. 22: Centaurea deusta; R. 23: Polycarpon tetraphyllum subsp. tetraphyllum, Hedypnois tubaeformis; R. 26: Salvia multifida, Parapholis incurva; R. 28: Parapholis incurva; R. 29: Hypochoeris radicata (r), Aphanes pupilla (r), Trifolium fragiferum, Convolvulus arvensis; R. 30: Allium ampeloprasum, Crepis apula, Alkanna tintoria; R. 31: Parapholis incurva; R. 32: Urginea marittima, Trifolium striatum, Plantago serraria, Medicago disciformis, Cynodon dactylon; R. 33: Centaurea deusta (r), Satureja montana (r), Thesium linophyllon, Melica ciliata, Linum tenuifolium, Koeleria splendens (agg.), Globularia puntata, Carduus micropterus, Allium paniculatum (agg.); R. 34: Thesium divaricatum; R. 35: Tuberaria guttata; R. 36: Melica ciliata, Cynodon dactylon, Valerianella eriocarpa, Seseli viarum, Selaginella denticulata, Lathyrus cicera, Hypericum hirsutum, Cuscuta epithymum; R. 37: Selaginella denticulata, Hypericum hirsutum, Ornithogalum narbonense, Phagnalon rupestre, Fumana laevipes, Cistus salvifolius; R. 38: Cynodon dactylon, Polycarpon tetraphyllum subsp. tetraphyllum, Lolium rigidum; R. 64: Tortula intermedia; R. 65: Tortula intermedia (r), Centaurea deusta, Torilis nodosa, Scleranthus annuus, Erodium acaule; R. 66: Silene conica; R. 67: Tortella nitida (r), Erodium acaule; R. 68: Rhagadiolus stellatus; R. 69: Orchis coriophora subsp. fragrans (r), Lathyrus aphaca, Daucus broterii; R. 70: Stachys cretica subsp. salviifolia (r), Dorycnium pentaphyllum subsp. suffruticosum (r); Cerastium glomeratum (r), Centaurea napifolia, Cuscuta scandens subsp. cesatiana, Orobanche ramosa; R. 71: Orobanche crenata (r); R. 73: Sedum tenuifolium (r), Trifolium strictum, Muscari neglectum, Hornungia petraia, Bromus tectorum, Bromus squarrosus; R. 74: Allium subhirsutum, Teucrium fruticans, Globularia alypum; R. 75: Phlomis fruticosa (r), Sideritis syriaca (r), Valerianella eriocarpa, Dactylis glomerata, Rhagadiolus edulis, Prunus spinosa, Phleum bertoloni, Lathyrus sphaericus, Cerastium tomentosum; R. 76: Fumana laevipes, Centaurium tenuiflorum, Daucus carota, Cistus monspeliensis, Veronica anagallis-aquatica, Pulicaria odora, Ononis viscosa var. breviflora, Euphorbia serrata, Dorycnium hirsutum, Cruciata laevipes, Anemone hortensis; R. 77: Cuscuta epithymum, Pinus pinea (pl); R. 78: Cistus salvifolius, Vicia hirsuta, Theligonum cynocrambe, Erica arborea, Carex hallerana; R. 79: Theligonum cynocrambe, Carex hallerana, Valerianella eriocarpa, Silene italica subsp. nemoralis, Lens ervoides; R. 80: Erica arborea, Anemone hortensis, Allium subhirsutum, Melica ciliata, Daphne gnidium, Thymus vulgaris, Smilax aspera, Pistacia lentiscus, Phleum subulatum, Phillyrea latifoglia, Ononis brevifolia, Oenanthe pimpinelloides, Myrtus communis, Hypericum perfoliatum, Clematis flammula; R. 81: Scandix pecten-veneris, Sonchus asper; R. 101: Galium murale, Bryum bicolor, Barbula unguiculata; R. 106: Polygala nicaeensis (r), Leontodon hispidus, Dorycnium pentaphyllum subsp. suffruticosum, Globularia puntata, Serapias vomeracea, Pteridium aquilinum, Prunella laciniata, Lotus glabre; R. 110: Juniperus oxycedrus (r), Rhamnus alaternus, Olea europea; R. 111: Juniperus oxycedrus, Olea europea, Clematis vitalba, Dianthus balbisii subsp. balbisi; R. 112: Crepis lacera (r), Erica arborea, Juncus fontanesii; R. 113: Olea europea (r), Rhamnus alaternus (r), Sonchus asper (r), Selaginella denticulata (r), Orchis coriophora subsp. fragrans, Crepis bursifolia; R. 114: Lathyrus setifolius; R. 115: Prunus spinosa, Plantago serraria, Fumana arabica; R. 116: Plantago serraria; R. 117: Thesium divaricatum, Arisarum vulgare; R. 118: Daphne gnidium (r), Minuartia glomerata, Euphrasia tricuspidata, Carlina greca; R. 119: Juncus fontanesii, Orobanche crenata; R. 120: Orobanche crenata (r), Plantago serraria, Rhamnus alaternus, Verbascum thapsus, Valerianella discoidea, Cardopatum corymbosum; R. 121: Smilax aspera; R. 124: Selaginella denticulata, Vicia disperma; R. 125: Silene alba (r), Allium tenuiflorum

(r), Linum tenuifolium, Ulmus minor (pl), Torilis arvensis subsp. semipurpurea, Spartium junceum (s), Salvia pratensis subsp. haematodes, Pottia sp., Lonicera implexa, Lathyrus sylvestris; R. 131: Mercurialis annua, Bryum caespiticium; R. 132: Mercurialis annua; R. 133: Silene conica (r); R. 134: Muscari neglectum, Cladonia sp.; R. 135: Acinos alpinus; R. 136: Ornithogalum narbonense; R. 137: Convolvulus arvensis, Tragopogon porrifolius; R. 139: Pistacia lentiscus, Urginea marittima, Piptatherum miliaceum, Lobularia marittima; R. 140: Pinus pinea (pl), Hedysarum coronarium, Andryala integrifolia, Medicago sativa; R. 141: Aphanes pusilla, Veronica persica; R. 143: Centaurea deusta; R. 145: Ornithogalum narbonense, Ophrys bertolonii, Cuscuta epithymum; R. 146: Anthyllis vulneraria, Lagurus ovatus; R. 147: Andryala integrifolia, Tolpis umbellata, Polygonum romanum, Petrorhagia velutina, Erodium ciconium; R. 148: Tortula muralis; R. 149: Senecio vulgaris, Jasione chinata, Anthoxanthum odoratum; R. 151: Cuscuta epithymum; R. 153: Orlaya grandiflora, Knautia integrifolia, Draba muralis; R. 154: Fumana procumbens, Stipa dasyvaginata subsp. apenninicola; R. 156: Carduus carlinaefolius; R. 157: Barbula unguiculata; R. 158: Pistacia terebinthus (r), Euphorbia spinosa; R. 159: Crepis bursifolia, Torilis nodosa, Trifolium filiforme, Sagina apetala, Cerastium holosteoides; R. 160: Torilis nodosa (r), Knautia arvensis, Bellis perennis, Verbena officinalis, Ranunculus velutinus, Picris echioides, Parentucellia viscosa, Geranium dissectum, Crepis vesicaria subsp. vesicaria; R. 161: Tortula intermedia (r), Trichostomum crispulum; R. 163: Rubus ulmifolius; R. 164: Tortula intermedia, Tortella nitida, Bryum pallescens; R. 166: Cistus salvifolius, Daucus carota, Ononis viscosa var. breviflora, Parentucellia latifoglia, Ornithogalum umbellatum, Cerastium granulatum; R. 167: Ononis viscosa var. breviflora, Parentucellia latifolia, Cerastium granulatum, Euphorbia spinosa, Muscari neglectum, Hornungia petraea, Leontodon tuberosus; R. 168: Bryum caespiticium; R. 169: Vulpia geniculata (r), Convolvulus arvensis, Pteridium aquilinum, Hypochoeris radicata, Trifolium repens, Ranunculus bulbosus subsp. bulbosus.

Herb height, centimetres
Herb cover, %
Sample area, square metres
Slope, degrees
Aspect, degrees
altitude (m)
sp/rel

***Medicago-Trifolietum scabri* (A)**

Medicago littoralis
Lotus edulis
Melilotus sulcatus
Plantago lagopus
Hymenocarpus circinnatus
Medicago rigidula
Trifolium cherleri
Medicago truncatula
Trifolium lappaceum

***Trifolo-Hypochoeridetum achyrophori* s.s. (B)**

Hedypnois rhagadioloides
Helianthemum salicifolium
Plantago bellardi
Euphorbia falcata
Euphorbia exigua
Ononis reclinata
Galium parisiense
Xeranthemum inapertum
Asterolinon linum-stellatum
Hippocrepis ciliata
Trigonella monspeliaca

***Hippocrepido-Brachypodietum distachyi* ©**

Polygala monspeliaca
Hippocrepis unisiliquosa
Althaea hirsuta

***Trigonello-Brachypodietum distachyi* (D)**

Trigonella gladiata
Minuartia hybrida
Ononis pusilla

***Crucianello-Hypochoeridetum achyrophori* (E)**

Crucianella latifolia

Trachynion distachyae

Coronilla scorpioides
Scorpiurus muricatus
Trifolium stellatum
Crepis neglecta
Plantago afra
Trifolium scabrum
Hypochoeris achyrophorus
Sideritis romana
Medicago minima
Brachypodium distachyum
Linum strictum sl
Blackstonia perfoliata

Stipo-Trachynetea distachyae

Crupina vulgaris
Onobrychis caput-galli
Ajuga chamaepitys
Micropus erectus
Taeniatherum caput-medusae
Lithospermum apulum
Silene nocturna
Medicago praecox
Echinaria capitata
Astragalus sesameus
Trifolium lucanum
Aegilops biuncialis
Ononis minutissima
Ononis ornithopodioides
Bupleurum semicompositum
Allium chamaemoly

Brometalia rubenti-tectorum

Catapodium rigidum
Avena barbata
Aegilops geniculata
Urospermum dalechampii
Tordylium apulum
Lotus ornithopodioides
Medicago orbicularis
Galactites tomentosa
Arenaria serpyllifolia
Pallenis spinosa
Carthamus lanatus
Bromus madritensis
Rostraria cristata
Trifolium angustifolium
Dasypyrum villosum
Astragalus hamosus
Urospermum picroides
Securigera securidaca
Echium plantagineum
Stipa capensis
Bellardia trixago
Melilotus indicus
Trifolium squarrosum
Trifolium nigrescens
Vicia villosa ssp. varia
Bromus rubens
Avena sterilis
Trifolium echinatum
Ammoides pusilla
Bromus diandrus
Trisetaria panicea
Silene bellidifolia
Medicago intertexta
Aegilops neglecta

Helianthemetalia

Trifolium campestre v. subproc
Sherardia arvensis
Vulpia ciliata
Briza maxima
Petrorhagia prolifera
Linum trigynum
Romulea bulbocodium
Crepis zacintha
Anagallis foemina
Vulpia ligustica
Vulpia myuros
Medicago polymorpha
Linum bienne
Cerastium ligusticum
Trifolium glomeratum
Ogliſa gallica
Gaudinia fragilis
Aira elegantissima
Psilurus aristatus
Silene gallica
Lotus angustissimus
Papaver rhoeas
Rumex bucephalophorus
Gastridium ventricosum
Anagallis arvensis ssp. parvif
Trifolium subterraneum
Ornithopus compressus
Hypochoeris glabra
Hypericum australe
Coleostephus myconis
Centaurium maritimum
Carex caryophyllea
Aira cupaniana
Astragalus pelecinus

Koelerio-Corynephoretea

Arenaria leptoclados
Poa bulbosa
Sedum sexangulare
Sedum rupestre
Campanula erinus
Cerastium pumilum
Sedum album
Minuartia mediterranea
Sedum hispanicum
Valantia muralis
Cerastium semidecandrum
Erophila verna ssp. verna
Sedum stellatum
Seseli tortuosum
Sedum rubens
Alyssum minus
Sedum atratum
Sedum caespitosum
Sedum dasyphyllum
Scleranthus polycarpos ssp. co

Festuco-Brometea

Petrorhagia saxifraga ssp. sax
Bupleurum baldense
Bromus erectus
Satureja acinos
Galium lucidum
Phleum ambiguum
Teucrium chamaedrys
Silene vulgaris ssp. vulgaris
Alyssum alyssoides
Helichrysum italicum ssp. ital
Thymus longicaulis
Scabiosa columbaria
Erysimum pseudorhaeticum
Leontodon hirtus
Eryngium amethystinum
Eryngium campestre
Carlina vulgaris
Melica transsylvanica
Hieracium pilosella
Linaria purpurea
Helianthemum nummularium ssp.
Festuca robustifolia
Carex flacca ssp. serrulata
Aethionema saxatile
Stachys heraclea
Polygala flavescens
Cleistogenes serotina
Xeranthemum cylindraceum
Galium corrudifolium
Asperula aristata ssp. scabra
Tyrymnus leucographus
Inula montana
Cerastium fontanum
Cephalaria leucantha
Centaurea parlatoris ssp. nigr
Brachypodium rupestre
Festuca circummediterranea
Medicago falcata
Botriochloa ischaemum
Thymus pulegioides aggr.

Lygeo-Stipetea

Convolvulus cantabrica
Salvia verbenaca
Carlina corymbosa
Scabiosa maritima
Ampelodesmos mauritanica
Satureja calamintha
Hyparrhenia hirta ssp. pubesce
Elaeoselinum asclepium ssp. as
Carduncellus coeruleus
Asphodelus ramosus
Tripodion tetraphyllum
Kundmannia sicula
Anthyllis vulneraria ssp. rubr
Lathyrus latifolius
Foeniculum vulgare ssp. piperi
Convolvulus althaeoides
Bituminaria bituminosa
Convolvulus elegantissimus
Andropogon distichum

Stellarietea

Anagallis arvensis ssp. arvens
Erodium malacoides
Euphorbia peplus
Geranium rotundifolium
Sonchus oleraceus
Veronica arvensis
Calendula arvensis
Capsella rubella
Geranium molle
Euphorbia helioscopia
Carduus pycnocephalus

companions

Sanguisorba minor ssp. muricat
Dactylis glomerata v. italica
Anthemis arvensis ssp. incrass
Reichardia picroides
Plantago lanceolata
Satureja graeca ssp. graeca
Filago pyramidata
Lythrum hyssopifolia
Crepis sancta
Filago germanica
Hypericum perforatum
Teucrium capitatum
Erodium cicutarium ssp. cicuta
Satureja graeca ssp. tenuifoli
Euphorbia dendroides
Geranium columbinum
Odontites lutea
Nigella damascena
Bromus hordeaceus ssp. hordeac
Anthemis tinctoria
Medicago lupulina
Lolium perenne
Leopoldia comosa
Echium vulgare
Cynosurus echinatus
Allium vineale
Pleurochaete squarrosa
Rostraria litorea
Potentilla hirta
Gladiolus byzanthinus
Allium roseum
Lotus corniculatus
Euphorbia characias
Vicia sativa
Verbascum sinuatum
Salvia viridis
Picris hieracioides ssp. spinu
Fumana thymifolia
Cynoglossum creticum
Centaurium pulchellum
Brachypodium retusum
Asparagus acutifolius
Aetheorrhiza bulbosa
Vicia sativa ssp. nigra
Spartium junceum
Sonchus tenerrimus
Saponaria calabrica
Ranunculus bulbosus ssp. aleae
Misopates calycinum
Mentha suaveolens
Lactuca viminea
Dactylis glomerata v. glomerat
Centaurium erythraea
Centaurea sphaerocephala

sporadic species