

A phytosociological analysis of the formations of *Ulex europaeus* L. of the North-Western Apennines (Italy)

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Abstract

We here present a phytosociological study of the formations of *Ulex europaeus* present in the North-Western Apennines, in the Regions of Liguria and Tuscany, that have been included in the new association *Cytiso villosi-Ulicetum europaei*.

Key words: *Cytisetea scopario-striati*, shrubby heath, *Ulex europaeus* vegetation.

Riassunto

Analisi fitosociologica delle formazioni a *Ulex europaeus* L. presenti nel settore nord-occidentale dell'Appennino (Italia). Viene presentato lo studio fitosociologico delle formazioni ad *Ulex europaeus* presenti nell'Appennino nord-occidentale, nelle regioni Liguria e Toscana, che vengono attribuite alla nuova associazione *Cytiso villosi-Ulicetum europaei*.

Parole chiave: *Cytisetea scopario-striati*, lande arbustive, vegetazione ad *Ulex europaeus*.

Introduction

The aim of the present study is the phytosociological classification of the formations of *Ulex europaeus* subsp. *europaeus* found in the Northern Apennines, in the Regions of Liguria and Tuscany (Fig. 1). These phytocoenoses are localised preferentially on acid substrata of locations that have, according to the bioclimatic classification proposed by Rivas-Martínez (1996), a temperate macrobioclimate, of the Submediterranean variant. However, from the microclimate point of view, these locations demonstrate strong oceanic characteristics (with abundant precipitation, and with fog and mist) (Fig. 2).

Ulex europaeus is a phanerophyte of a bushy nature with a mainly South-West European distribution area found in the Atlantic European Province (the Cantabroatlantic, Orocantabrian and Britannic Subprovinces), the Central European Province (the Subatlantic Subprovince), the Balearic-Catalanian-Provençal Province (the Occitanian-Provençal Subprovince) and the Italo-Thyrrhenian Province (the West Coastal Italian Subprovince). Some Italian populations can be found also in the Apennino-Balkan Province (the Apennine Subprovince). The Italian populations are therefore the most southern of the

spontaneous distribution area of the species and they are part of floristic-vegetation and bioclimatic contexts that are definitely very different from those Atlantic. For this reason, the Italian shrubberies of *Ulex europaeus* represent a vegetation type of particular interest, even if they present some difficulties in their syntaxonomic classification. *Ulex europaeus* is an abundant species in small heath areas, on decapitated soil, although the fact that it finds its best conditions on humid and deep soils confirms that it belongs to the forest woody shrub communities. Rivas-Martínez *et al.* (2002) consider this species characteristic of the alliance *Ulici-Cytisium striati* (*Cytisetea scopario-striati*).

The *Ulex europaeus* vegetation found in Italy has already been the subject of two main studies: the first of these concerned the formations found in Eastern Liguria that have been referred generically, although with some doubt, to the class *Calluno-Ulicetea* (Mariotti, 1989); the second studies the formations of *Ulex europaeus* of the territory of the Republic of San Marino, where the species, which is found in a single location, reaches its most eastern limits of its Italian distribution area. The vegetation found was classified to the association *Crataego monogynae-Ulicetum europaei*, fully referable, in a dynamic, floristic and ecological context, to the class *Rhamno-Prunetea* (Biondi & Vagge, 2004).

Materials and Methods

Twenty-eight phytosociological relevés of shrubby formations of *Ulex europaeus* were performed in the territories indicated in Fig. 2. These formations show a mean height of 1.8 m and are very dense and sometimes almost impenetrable, especially where they present a 100% coverage and the dominant species consequently becomes the only shrubby form found, with the exception of some brambles and climbing bushes. These relevés have been collected together with 5 relevés taken from the Table of the study of Mariotti (1989) into a single matrix, which is thus made up of 33 relevés with 105 species. After the conversion of the phytosociological codes into their quantitative values (Van der Maarel, 1979), the relevés were classified according to the average linkage algorithm on the basis of the similarity matrix between the relevés, calculated with the similarity ratio option with respect to the coverage (Westoff & Van der Maarel, 1978), which has allowed the construction of a dendrogram (Fig. 3) on the basis of which the phytosociological table has been ordered (Tab. 1).

Results and Discussion

From the phytosociological table (Tab. 1), we propose the new association *Cytiso villosi-Ulicetum europaei* (holotype rel. N° 34) that has as its characteristic species *Ulex europaeus*, *Erica arborea* and *Cytisus villosus*, and

as its differential species *Teucrium scorodonia*, *Cistus salvifolius*, *Erica scoparia*, *Genista pilosa* and *Calluna vulgaris*. As can be clearly seen from the dendrogram (Fig. 3), the association has two subassociations (clusters I and II), the second of which has two ecological variants (IIa and IIb).

The *cytisetosum villosii* subassociation (rel. type N° 34) (cluster II) represents the typical aspect of the association. It has a more thermophilic variant that is differentiated by *Calicotome spinosa* and *Rosa sempervirens* and by a good number of Mediterranean species of the order *Pistacio-Rhamnetalia alaterni*. The formations that colonise shallow valleys (ZONE DI LEGGERO IMPLUVIO) with more humid soils make up instead a variant differentiated by *Myrtus communis* and *Smilax aspera* (cluster IIb).

The *cytisetosum scoparii* subassociation (rel. type N°1) (cluster I), differentiated by *Cytisus scoparius* and by the absence of species such as *Asparagus acutifolius* and *Fraxinus ornus*, represents the most sciaphilic and mesophilic aspects of the association with respect to the formations found at greater altitude or in more internal locations in terms of distance from the coast-line, where they colonise rain channels with an accumulation of detritus on the substratum. In particular, the shrubs found at the greatest altitudes have a noted floristic poverty and come into contact with chestnut and Turkey oak woods. In these situations, the structure of the vegetation, which is almost exclusively determined by *Cytisus scoparius* and *Ulex europaeus*, could allow these formations to be attributed to the

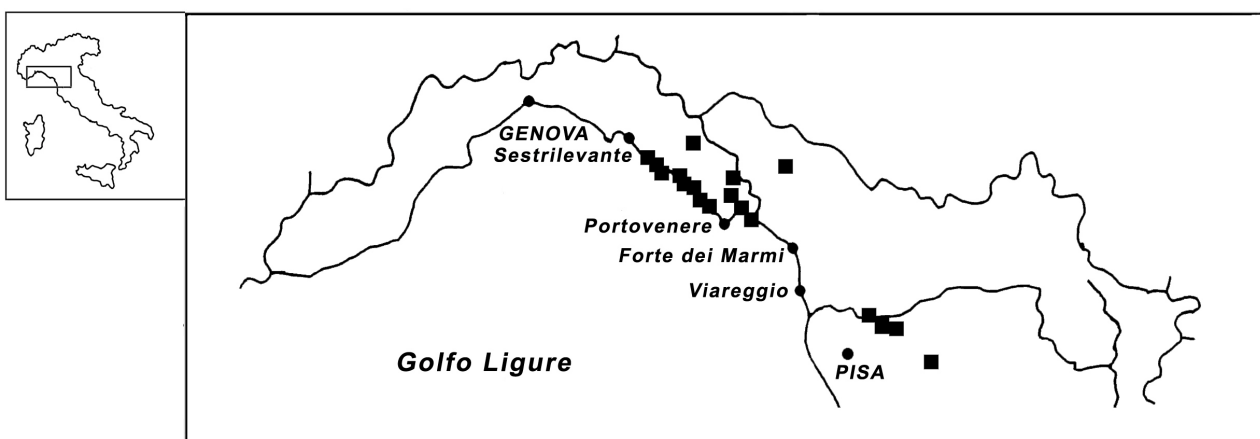
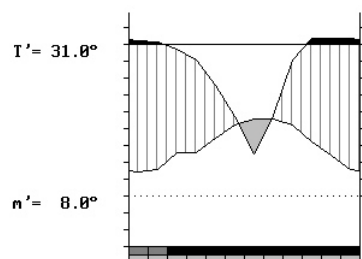


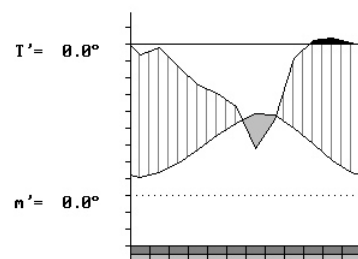
Fig. 1 – Localisation of the areas studied

LA SPEZIA (ITALIA) 5 m
 P= 1090 44° 6'N 2°38'E 33/ 38 a
 T= 15.2° Ic= 16.0 Tp= 1020 Tn= 0
 n= 4.0 M= 10.0 Itc= 292 Io= 6.0



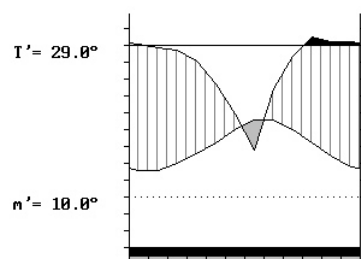
MEDITERRANEAN PLUVISEASONAL-OCEANIC
 LOW MESOMEDITERRANEAN UPPER SUBHUMID

PONTEDERA (ITALIA) 0 m
 P= 960 43° 39'N 10°38'E 30/ 38 a
 T= 14.7° Ic= 18.9 Tp= 1759 Tn= 0
 n= 2.6 M= 8.4 Itc= 261 Io= 5.5



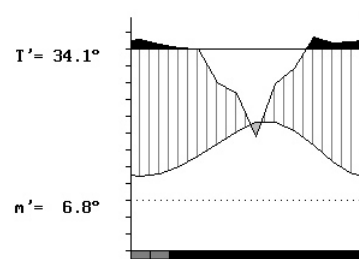
MEDITERRANEAN PLUVISEASONAL-OCEANIC
 UPPER MESOMEDITERRANEAN UPPER SUBHUMID

LEVANTO (ITALIA) 2 m
 P= 1070 44° 10'N 2°50'E 22/ 38 a
 T= 14.0° Ic= 15.0 Tp= 1700 Tn= 0
 n= 4.0 M= 12.0 Itc= 308 Io= 6.0



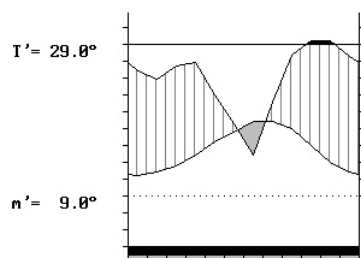
TEMPERATE OCEANIC (SUBMEDITERRANEAN)
 UPPER THERMOTEMPERATURE (MESOSUBMEDIT.) LOW HUMID

SARZANA (ITALIA) 26 m
 P= 1264 44° 7'N 2°29'E 57/ 38 a
 T= 14.9° Ic= 16.2 Tp= 1785 Tn= 0
 n= 1.7 M= 12.4 Itc= 290 Io= 7.1



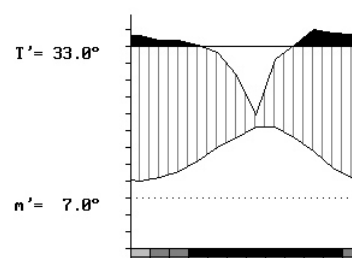
TEMPERATE OCEANIC (SUBMEDITERRANEAN)
 LOW MESOTEMPERATURE (MESOSUBMEDIT.) LOW HUMID

PISA (ITALIA) 1 m
 P= 896 45° 68'N 10°38'E 30/ 38 a
 T= 13.8° Ic= 16.0 Tp= 1650 Tn= 0
 n= 2.0 M= 10.0 Itc= 258 Io= 5.4



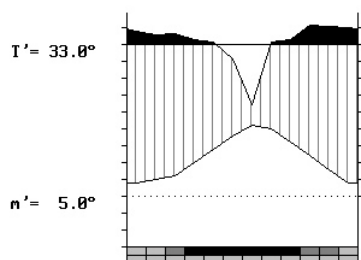
TEMPERATE OCEANIC (SUBMEDITERRANEAN)
 LOW MESOTEMPERATURE (MESOSUBMEDIT.) UPPER SUBHUMID

NOVEGINO (AULLA) (ITALIA) 55 m
 P= 1499 44° 12'N 2°31'E 26/ 38 a
 T= 12.7° Ic= 16.0 Tp= 1520 Tn= 0
 n= 0.0 M= 10.0 Itc= 227 Io= 9.9



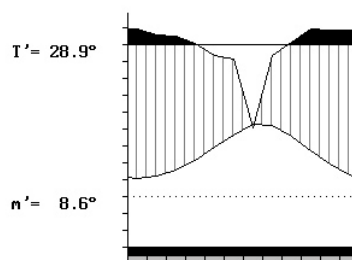
TEMPERATE OCEANIC
 UPPER MESOTEMPERATURE UPPER HUMID

PONTE SANTA MARCHERITA (ITALIA) 200 m
 P= 1777 44° 16'N 2°48'E 22/ 38 a
 T= 11.5° Ic= 17.0 Tp= 1300 Tn= 0
 n= 0.0 M= 8.0 Itc= 195 Io= 12.9



TEMPERATE OCEANIC
 UPPER MESOTEMPERATURE LOW HYPERHUMID

MATTARANA (BARACCA BRACCO) (ITALIA) 590 m
 P= 1589 44° 15'N 2°52'E 18/ 38 a
 T= 12.7° Ic= 16.1 Tp= 1522 Tn= 0
 n= 2.4 M= 8.0 Itc= 231 Io= 10.4



TEMPERATE OCEANIC (SUBMEDITERRANEAN)
 LOW MESOTEMPERATURE (MESOSUBMEDIT.) UPPER HUMID

Fig. 2 – Bioclimatic diagrams of the areas studied

<i>Rubia perigrina</i> L.	.	1.1	+	1.2	.	.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	1.2	1.2	+	.	20	IV	
<i>Quercus ilex</i> L.	+	.	.	1.2	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15	III
<i>Clematis vitalba</i> L.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11	II
<i>Arbutus unedo</i> L.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	II
<i>Crataegus monogyna</i> Jacq.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8	II
<i>Castanea sativa</i> Miller	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8	II
<i>Daphne genkium</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	I
<i>Quercus cerris</i> L.	1.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	I
<i>Asplenium onopteris</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	I
<i>Dactylis glomerata</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	I
<i>Hedera helix</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	I
<i>Pulsatilla odora</i> (L.) Rehb.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	I
<i>Rubus</i> sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	I
<i>Molinia arundinacea</i> Schrank	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	I
<i>Erica carnea</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	I
<i>Lonicera etrusca</i> Santi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	I
<i>Rosa canina</i> L. sensu Bouleng.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	I
<i>Spartium juncifolium</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	I
<i>Quercus pubescens</i> Willd.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	I
<i>Hieracium racemosum</i> W. et K.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	I
<i>Viola riviniana</i> Rehb.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	I
<i>Cistus creticus</i> L. subsp. <i>eritrocephalus</i>	1.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	I
<i>Oxyris alba</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	I
<i>Clematis flammula</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	I
<i>Tamus communis</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	I
<i>Dorycnium hirsutum</i> (L.) Ser.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	I
<i>Brachypodium ramosum</i> (L.) R. et S.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	I
<i>Lathyrus sylvestris</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	I
<i>Lavandula stoechas</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	I
<i>Odontites lutea</i> (L.) Clairv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	I
<i>Stachys officinalis</i> (L.) Trevisan	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	I
<i>Viola reichenbachiana</i> Jordan ex Boreau	+	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	I
<i>Avenella flexuosa</i> (L.) Parl.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	I
<i>Ostrya carpinifolia</i> Scop.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	I
Accidental species	.	1	.	6	1	4	.	1	2	2	2	1	2	1	.	3	5	.	3	6	.	1	2	1	1	1

association *Ulici-Sarothamnietum scoparii*, described for Central Europe and classified in the alliance *Sarothamnion scoparii* (Oberdorfer, 1992). However, the different serial dynamic, ecological, floristic and bioclimatic contexts in which the Apennine vegetation is found excludes it from this association.

From the syntaxonomic point of view, the possibility of including the new association in the *Calluno-Ulicetea* class is excluded because, even if the physiognomic-structural aspect of some formations remind one of that of the Subatlantic bushy heaths, in reality there is a very low presence of species of this class and the ecological and bioclimatic contexts are completely different. In the same way, inclusion in the class *Rhamno-Prunetea* is excluded, and inclusion in the order *Pistacio-*

Rhamnetalia (Quercetea ilcis) would be extremely difficult: some species of this order differentiate only the most thermophilic aspects of the association. Therefore, we attribute the association described to the class *Cytisetea scopario-striati*. This class, which is mainly represented in the Iberian Peninsula, includes communities of coverage of deciduous woods of Mediterranean, Submediterranean and Temperate bioclimates, with humid and subhumid ombroclimates, which colonise acid substrata (Rivas-Martínez & Belmonte, 1987; Rivas-Martínez *et al.*, 2002). In terms of the syntaxa of lower orders, these are referred to the order *Cytiso villosi-Telinetalia monspessulanae* that includes only the alliance *Telinion monspessulano-linifoliae*.

Syntaxonomic scheme

CYTISETEA SCOPARIO-STRIATI Rivas-Martínez 1975

Cytiso villosi-Telinetalia monspessulanae Rivas-Martínez, Galán & Cantó 2002

Telinion monspessulano-linifoliae Rivas-Martínez, Galán & Cantó 2002

Cytiso villosi-Ulicetum europaei ass. nova

cytisetosum villosi subass. nova (typical aspect)

cytisetosum scopariae subass. nova

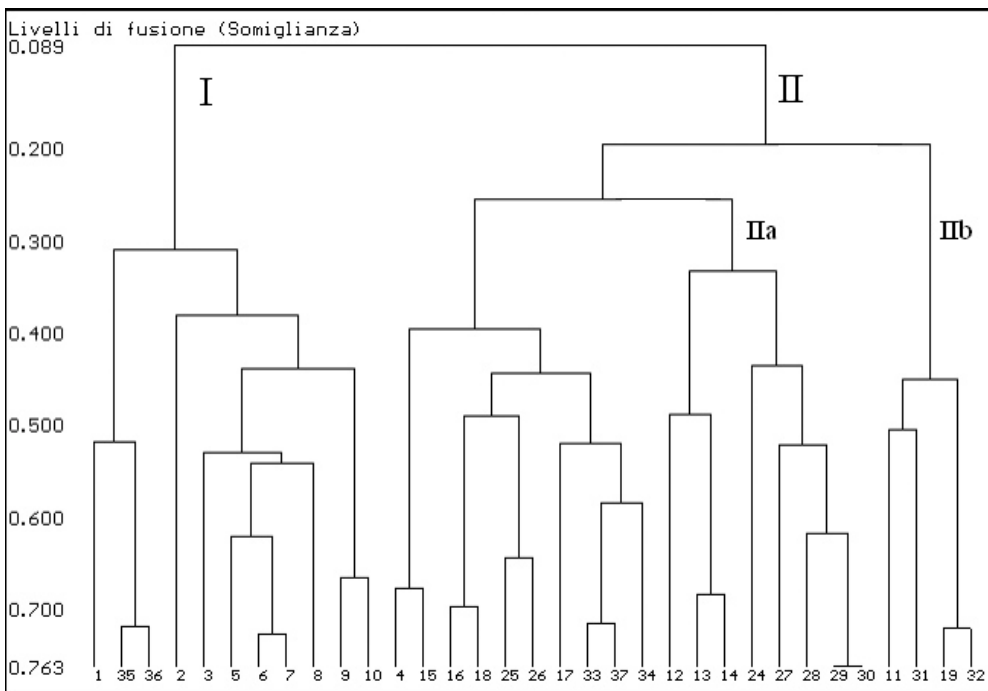


Fig. 3 – Dendrogram of the releveés presented in Tab. 1

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Addenda

Locality and date of the relevés

Ril. 1: La Cigoletta presso Corniglia 20.07.88 [Mariotti, 1989]; ril. 2, ril. 6: Beverone (Strada per Garbugliaga SP) – 20.06.1991; ril. 3: tra la Cigoletta e Monte Gaginaro 20.07.88 [Mariotti, 1989]; ril. 4: tra case Bagari e Monte Marvede sopra Volastra 20.07.88 [Mariotti, 1989]; ril. 5: Foce dei Vaggi (Bonassola – SP) 25.06.93; ril. 7: Aulla (Strada per Fivizzano) 06.05.94; ril. 8: Liscignano Fivizzano 06.05.94; ril. 9, ril. 10: Santo Stefano Magra -SP 06.05.94; ril. 11: Bocca di Magra 17.05.85 [Mariotti, 1989]; ril. 12: Costa Acquapendente;

27.07.84 [Mariotti, 1989]; ril. 13: Mattarana (SP) 22.08.93; ril. 14: Strada per San Giorgio (Bonassola – SP) 25.06.93; ril. 15: Foce dei Vaggi (Bonassola – SP) 25.06.93; ril. 16, ril. 17: strada da Treggiaia a Pontedera (Santuario Madonna di Ripaia) 30.03.99; ril. 18, ril. 19: strada per Monte Serra (PI) 02.09.1999; ril. 24, ril. 25: Mattarana - SP 28.06.03; ril. 26: Framura – SP: strada da Baracchetta Bracco a Bonassola 28.06.03; ril. 27, ril. 28: Monte Soviore Monterosso – SP 28.06.03; ril. 29, ril. 30: Monte S. Croce Monterosso – SP 28.06.03; ril. 31, ril. 32, ril. 33: strada per Monte Serra salendo da Calci (PI) 29.06.03; ril. 34, 35, 36: strada dal Monte Serra a Buti (PI) 29.06.03; ril. 37: strada per Monte Serra salendo da Calci (PI) 30.06.03.

Accidental species

Ril. 1: *Potentilla erecta* (L.) Rauschel +2, *Polygala vulgaris* L. +, *Viola canina* L. +, *Holcus lanatus* L. +, *Fragaria vesca* L. +, *Leucanthemum vulgare* Lam. +; ril. 2: *Lonicera caprifolium* L. +; ril. 3: *Lilium bulbiferum* L. subsp. *croceum* (Chaix) Baker +, *Clinopodium vulgare* L. +; ril. 4: *Cynosurus cristatus* L. +; ril. 5: *Eupatorium cannabinum* L. +; ril. 6: *Galium album* Miller +; ril. 7: *Calystegia sylvatica* (Kit.) Griseb. 1.2, *Solanum dulcamara* L. +; ril. 8: *Ligustrum vulgare* L. 1.2, *Euonymus europaeus* L. +2; ril. 10: *Populus tremula* L. 2.3; ril. 11: *Frangula alnus* Miller 1.1, *Plantago lanceolata* L. +, *Juniperus oxycedrus* L. subsp. *oxycedrus* +; ril. 12: *Briza maxima* L. +, *Cynosurus echinatus* L. +; ril. 13: *Silene italica* (L.) Pers. +, *Corylus avellana* L. +; ril. 14: *Pistacia terebinthus* L. 1.1; ril. 16: *Viburnum tinus* L. 1.2; ril. 17: *Serratula tinctoria* L. 1.2, *Genista germanica* L. +, *Prunus spinosa* L. +, *Juniperus communis* L. +; ril. 24: *Genista januensis* Viv. +, *Peucedanum oreoselinum* (L.) Moench +; ril. 25: *Schoenus nigricans* L. 1.2, *Dorycnium pentaphyllum* Scop. subsp. *herbaceum* (Vill.) Rouy 1.1, *Galium lucidum* All. +, *Holoschoenus romanus* (L.) Fritsch +, *Carex flacca* Schreber +, *Helianthemum nummularium* (L.) Miller subsp. *obscurum* (Celak.) Holub +; ril. 26: *Cruciata glabra* (L.) Ehrend. +; ril. 27: *Cytisus sessilifolius* L. 1.2; ril. 29: *Anthoxanthum odoratum* L. +2; ril. 31: *Laurus nobilis* L. +, *Phillyrea media* L. +, *Rhamnus alaternus* L. +, *Rosa* sp. +, *Solidago virgaurea* L. +; ril. 32: *Lonicera implexa* Aiton +, *Phillyrea angustifolia* L. +, *Cymbopogon hirtus* (L.) Janchen +; ril. 34: *Quercus petraea* (Mattuschka) Liebl. (pl.) +, *Agrostis* sp. +; ril. 37: *Polypodium vulgare* L. +.