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The Sicilian taxa of *Genista* sect. *Voglera* and their phytosociological framework

Abstract

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The phytosociological role of taxa of *Genista* sect. *Voglera* in the vegetation context of Sicily is here examined. It was carried out on plant communities characterised by the Sicilian endemics *G. aristata, G. madoniensis* and *G. cupanii*. These taxa and their floristic settlement have been examined from the biogeographical point of view. Basing on our results, the populations of *G. madoniensis* are to be referred to a new association named *Cisto salvifolii-Genistetum madoniensis*, ascribed to the class *Cisto-Lavanduletea*. Multivariate analysis shows a clear ecological differentiation of *G. madoniensis* with respect to the other Sicilian species. Instead, its habitus and ecology are closer to some spiny *Genista* of the Iberian Peninsula.

Key words: Biodiversity, Phytosociology, Cisto-Lavanduletea, Mediterranean region, Sicily.

Introduction

The genus *Genista* L. includes around 200 shrubby *taxa,* which are mainly distributed in the Mediterranean and nearest regions. The distribution of the genus stretches up to NW Europe, while in the south it outlines the boundaries of the Mediterranean region in Northern Africa. The highest concentration of species is found in the Iberian Peninsula. This genus is also widespread in western and central Europe, extending out to the South-East of Russia, into Turkey, Syria and the Caucasus (Gibbs 1966; Valsecchi 1993). The representatives of the genus at issue are mainly found in shrubland on various substrata, under different climatic conditions, preferring highly permeable, often leached soils. They usually have a xeromorphic and even spiny habitus, frequently forming typical chasmophytic cushions. Likewise, they occur on mountain ridges, under extreme climatic conditions and strong winds. Goats, sheeps and cows, grazing the upper branches, can contribute to modify the vegetative and structural features of the cushions (Guarino & al. 2006).

The section *Voglera* (P. Gaertn., B. Mey. & Schreb.) Spach includes suffruticose spiny shrubs with alternate branches, terminating in a spine that is silky or hairy when young, the

most typical morphologic trait of the sect. being a floral keel with 4-10 veined wings in the form of an inverted V.

On the whole, in the Mediterranean region the Sect. *Voglera* consists of 14 species and 11 subspecies (Tab. 1), (Fig. 1), including *G. aristata* C. Presl, *G. cupanii* Guss. and *G. madoniensis* Raimondo (Conti & al. 2005; Giardina & al. 2007; Gibbs & al. 1968; Pignatti 1982; Tavalera 1999; Vicioso 1953). The first of these species is endemic to a limited geographical area of the northern mountain ranges of Sicily (Madonie Mts, Nebrodi Mts), while the other two are exclusively found in the Madonie Mts., at different elevations. According to Quézel (1985), these Sicilian *taxa* should be related to some species of the western Mediterranean region, to which Sicily was connected during the Messinian salinity crisis, between 5 and 7 million years ago (Bocquet & al. 1978; Hsü & al. 1973).

The communities of *Genista* Sect. *Voglera* in the Mediterranean area

With the exception of *G. germanica*, which is mainly found in territories with a temperate bioclimate, all the other species of *Genista* Sect. *Voglera* characterise forest and preforest communities under a typical Mediterranean bioclimate, with dry to humid ombrotypes (Rivas-Martínez & al. 2001).

Table 1. Report of the *Genista* sect. *Voglera* species in the Mediterranean Region.

1. *G. anatolica* Boiss., Diagn. Pl. Or. Nov. 1(2): 8 (1843)
2. *G. aristata* C.Presl, J. & C. Presl, Del. Prag. 34 (1822)
3. *G. carinalis* Griseb, Splicil. Fl. Rumel. 1: 3 (1843)
4. *G. cupanii* Guss., Cat. Pl. Boccad. 77 (1821)
5. *G. germanica* L., Sp. Pl. 710 (1753)
6. *G. hirsuta* Vahl, Symb. Bot. 1: 51 (1790)
   a. *G. hirsuta* subsp. *hirsuta*
   b. *G. hirsuta* subsp. *lanuginosa* (Spach) Nyman, Consp. Fl. Eur.: 151 (1878)
   c. *G. hirsuta* subsp. *erioclada* (Spach) Raynaud, Naturalia Monspel., Sér. Bot. 28: 49 (1890)
7. *G. hispanica* L., Sp. Pl.: 711 (1753)
   a. *G. hispanica* subsp. *hispanica*
   b. *G. hispanica* subsp. *occidentalis* Rouy, Rouy & Foucaud, Fl. France 4: 226 (1897)
8. *G. madoniensis* Raimondo, Fl. Medit. 9: 319 (1999)
9. *G. micrantha* Gómez Ortega, Nov. Pl. Descr. Dec.: 68, Tab. 10, 1 (1798)
10. *G. sylvestris* Scop., Fl. Carn. Ed. 2, 2: 53 (1772)
    a. *G. sylvestrys* Scop. subsp. *sylvestris*
    b. *G. sylvestrys* subsp. *dalmatica* (Bartl.) Lindb., Oefvers. Förh. Finska Vetensk.-Soc. 48: 48 (1906)
11. *G. tournefortii* Spach subsp. *tournefortii*, Ann. Sci. Nat., Bot. Ser. 3, 2: 269 (1844)
12. *G. triacanthos* Brot., Phytogr. Lusit. Select. 1: 54 (1800)
    a. *Genista triacanthos* Brot. subsp. *triacanthos*
    b. *Genista triacanthos* subsp. *vepres* (Pomel) P.E.Gibbs, Notes Roy. Bot. Gard. Edinburgh 27: 77 (1966)
13. *G. tricuspidata* Desf., Fl. Atlant. 2: 138 (1798)
14. *G. tridens* (Cav.) DC., Prodr. 2: 148 (1825)
    a. subsp. *tridens*
    b. subsp. *juniperina* (Spach) Tavalera & P.E.Gibbs, Lagascalia 18: 271 (1996)

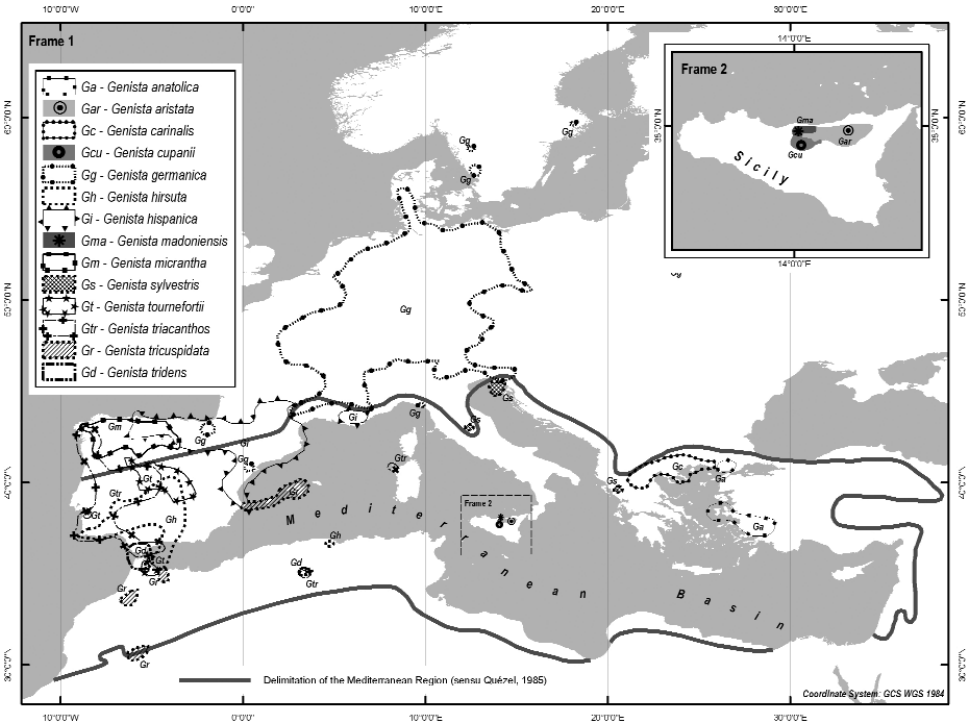

Fig. 1. Geographical distribution of the *Genista* section *Voglera* species in the Mediterranean region.

According to literature (Aksoy & al. 2010; Azzioui & al. 2000; Bergmeier & Dimopoulos 2008; Martínez -Parras & al. 1987; Ranđelović & Milosavljević 2008; Rivas-Martínez & al. 2001, 2002) the species of section *Voglera* characterise 36 plant communities referring to 12 classes (Tab. 2). Of special importance are thermoxerophilous vegetational aspects belonging the *Calluno-Ulicetea*, the *Cisto-Lavanduletea* and the *Rosmarinietea officinalis*. They have particular environmental significance in the Iberian Peninsula and Morocco.

Study area

The phytogeographical analysis of the considered *taxa* was focused on the Tyrrhenian side of Madonie Mts (N-Sicily), (Fig. 1). In this area, due to its ecological characteristics and its high level of biodiversity, various previous floristic and ecological investigations were carried out (Brullo 1984; Brullo & Marcenò 1985; Brullo & al. 1996, 2002; Pignatti & al. 1980; Raimondo 1980, 1999, 2000; Raimondo & al. 2004; Marino & al. 2012). Indeed, from the phytogeographical point of view, the Madonie Mts are to be considered as one of the biodiversity-hotspots of the Mediterranean basin, not only because of the remarkable floristic richess and ecological differentiation, but also because their flora

Table 2. Main *sintaxa* caracterized by species of *Genista* sect. *Voglera* in the Mediterranean Region.

Taxa	Association	Classes
G. anatolica	*Phillyreo-Pinetum brutiae* Schwarz 1936	*Quercetea pubescentis* (Oberd, 1948) Doing Kraft 1955
G. aristata	*Genisto aristatae-Quercetum suberis* Brullo 1984	Quercetea Ilicis Br.-Bl. ex A. & O. Bolos 1950
	Genisto-Potentilletum calabrae	*Molinio-Arrhenatheretea* R. Tx. 1937
G. carinalis	*Genisto carinalis-Quercetum petraeae* Bergmeier in Bergmeier & Dimopoulos 2008	*Querco-Fagetea* Br.-Bl. & Vlieger in Vlieger 1937
	Agrosti-Genistetum carinalis N. Ranđ. & V. Milos. 2008	*Festuco-Brometea* Br.-Bl. & R.Tx. 1943 ex Klika & Hadac 1944
G. cupanii	*Genistetum cupanii* Pignatti & Nimis 1980	*Rumici-Astragaletea siculi* Pignatti & Nimis in Pignatti & al. 1980 em. Mucina 1997
G. germanica	*Genisto germanicae-Quercion roboris* Neuhäusl & Neuhäuslová-Novotná 1967	*Quercetea robori-petraeae* Br.-Bl. & Tx. 1943
	Calluno-Genistetum germanicae Soò 1957	*Festuco-Brometea* Br.-Bl. & R.Tx. 1943 ex Klika & Hadac 1944
	Genisto germanicae-Callunetum Oberd. 1978	*Calluno-Ulicetea* Br.-Bl. & Tüxen ex Klika & Hadač 1944
	Genisto germanicae-Quercetum roboris Aichinger 1933	*Quercetea robori-petraeae* Br.-Bl. & Tx. 1943
G. hirsuta subsp. *hirsuta*	*Calicotomo villosae-Genistetum hirsutae* Martínez-Parras, Peinado & Cruz 1988	*Cisto-Lavanduletea* Br.-Bl. in Br.-Bl., Molinier & Wagner 1940
	Cisto albidi-Genistetum hirsutae Rivas-Martínez, Costa & Loidi 1992	*Cisto-Lavanduletea* Br.-Bl. in Br.-Bl., Molinier & Wagner 1940
	Genisto hirsutae-Cistetum ladaniferi Rivas Goday 1956	*Cisto-Lavanduletea* Br.-Bl. in Br.-Bl., Molinier & Wagner 1940
	Rosmarino-Cistetum ladaniferi genistetosum hirsutae Rivas-Martinez 1968 (Rivas Martìnez, 1970)	*Cisto-Lavanduletea* Br.-Bl. in Br.-Bl., Molinier & Wagner 1940
	Genisto eriocladae-Cistetum ladaniferi Quézel, Barbero, Benabid, Loisel & Rivas- Martinez 1988	*Cisto-Lavanduletea* Br.-Bl. in Br.-Bl., Molinier & Wagner 1940
G. hirsuta subsp. *erioclada*	*Genistetum erioclado-pseudoretamoidis* Quezel, Barbero, Benabid, Loisel & Rivas-Martinez 1992	*Rosmarinetea officinalis* Rivas-Martinez, T.E. Diaz, F. Prieto, Loidi & Penas 1991
	Calicotomo villosae-Genistetum lanuginosae Martínez Parras, Peinado y De la Cruz 1987 corr. Pérez Latorre, Galán de Mera, Deil y Cabezudo 1996	*Cisto-Lavanduletea* Br.-Bl. in Br.-Bl., Molinier & Wagner 1940
	Genisto lanuginosae-Cistetum populifolii Asensi & Díez-Garretas 1992	*Cisto-Lavanduletea* Br.-Bl. in Br.-Bl., Molinier & Wagner 1940
	Genisto moulleronii-Ericetum multiflorae Quézel, Barbero, Benabid, Loisel & Rivas-Martinez 1992.	*Rosmarinetea officinalis* Br.-Bl. 47 em. Rivas-Martínez & al. 91
	Coronillo junceae-Genistetum atlanticae Quézel, Barbero, Benabid, Loisel & Rivas-Martinez 1992.	*Rosmarinetea officinalis* Br.-Bl. 47 em. Rivas-Martínez & al. 91

Table 2. continued.

	Genistetum erioclado-Pseudoretamoidis Quézel, Barbero, Benabid, Loisel & Rivas-Martinez 1992.	*Rosmarinetea officinalis* Br.-Bl. 47 em. Rivas-Martínez & al. 91
	Genisto pseudopilosae-Bupleuretum lucidae Quézel, Barbero, Benabid, Loisel & Rivas-Martinez 1992.	*Rosmarinetea officinalis* Br.-Bl. 47 em. Rivas-Martínez & al. 91
G. hirsuta subsp. *lanuginosa*	*Genisto hispanicae-Anthyllidetum onobrychioidis* Costa, Peris & Figuerola 1983	*Rosmarinetea officinalis* Br.-Bl. 47 em. Rivas-Martínez & al. 91
G. hispanica	*Genisto hispanicae-Erinaceetum anthyllidis* Rivas Goday & Borja 1961 [*Diantho turolensis-Genistetum hispanicae* Roselló 1994 (syntax. Syn.)]	*Festuco hystricis-Ononidetea striatae* Rivas-Martínez, T.E. Díaz, F. Prieto, Loidi & Penas
	Aphyllantho monspeliensis – Genistetum hispanicae (Archiloque, Borel, Devaux, Lavagne, Moutte & Weiss 1970) Loisel 1976	*Rosmarinetea officinalis* Br.-Bl. 47 em. Rivas-Martínez & al. 91
	Genisto tournefortii-Quercetum pyrenaicae Rivas Goday 1964	*Querco-Fagetea* Br.-Bl. & Vlieger in Vlieger 1937
G. madoniensis	*Cisto salvifolii-Genistetum madoniensis* ass. nov. *hoc loco*	*Cisto-Lavanduletea* Br.-Bl. in Br.-Bl., Molinier & Wagner 1940
G. tournefortii	*Carici piluliferae-Genistetum triacanthi,* Honrado J 2005	*Calluno-Ulicetea* Br.-Bl. & Tüxen ex Klika & Hadač 1944
	Genisto jahandiezii-Quercetum rotundifoliae Barbero, Quézel & Rivas-Martinez 1981	*Querco-Fagetea* Br.-Bl. & Vlieger in Vlieger 1937
G. triacanthos	*Agrostido curtisii-Genistetum triacanthi* Izco ined.	*Calluno-Ulicetea* Br.-Bl. & Tüxen ex Klika & Hadač 1944
	Genisto triacanthi-Stauracanthetum spectabilis Rivas-Martínez, Lousã, T.E. Díaz, Fernández-González & J.C. Costa 1990 corr. Capelo 1999.	*Calluno-Ulicetea* Br.-Bl. & Tüxen ex Klika & Hadač 1944
	Genisto triacanthi-Ericetum ciliaris (Br.-Bl., P. Silva & Rozeira 1965) F. Prieto in T.E. Díaz 1998	*Calluno-Ulicetea* Br.-Bl. & Tüxen ex Klika & Hadač 1944
	Genisto triacanthi-Cistetum palhinhae Rivas-Martínez, Lousã, T.E. Díaz, Fernández-González & J.C. Costa 1990	*Calluno-Ulicetea* Br.-Bl. & Tüxen ex Klika & Hadač 1944
G. tricuspidata	*Lavandulo dentatae-Genistetum durieui* Quézel, Barbero, Benabid, Loisel & Rivas-Martinez 1992.	*Rosmarinetea officinalis* Br.-Bl. 47 em. Rivas-Martínez et al. 91
	Genisto sparsiflorae-Tetraclinetum articulatae Fennane 1982 em. 1988.	*Calluno-Ulicetea* Br.-Bl. & Tüxen ex Klika & Hadač 1944
G. tridens	*Genisto tridentis-Stauracanthetum boivinii* Rivas-Martínez 1979	*Calluno-Ulicetea* Br.-Bl. & Tüxen ex Klika & Hadač 1944

includes more than 20% endemics (Blondel & Aronson 1999; Quézel 1985). The choice of this area for the study was based on the co-existence in the territory of all three species of the genus *Genista* section *Voglera* occurring in Sicily.

Materials and methods

The study of vegetation was carried out through 45 original relevés, adopting the phytosociological method of the school of Zurich-Montpelier (Braun-Blanquet 1964; Géhu & Rivas-Martinez 1981; Géhu 1988; Tüxen 1979). These relevés, some of which relating to plant communities which have already been described in the past (Brullo 1984; Pignatti & al. 1980), were needed in order to provide a uniform basis (Braun-Blanquet 1964; Pignatti & Mengarda 1962) for the subsequent multivariate analysis.

The phytosociological framework of the *syntaxa* is in agreement with Rivas-Martínez & al. (2001) and Brullo & al. (2002, 2008). The taxonomic nomenclature follows Raimondo & al. (2010). For the quantitative evaluations of the species, the index of cover-abundance was used. The *taxa* were grouped according to the rank of their syntaxonomic indicators (differentials and characteristics), as defined by Brullo & al. (2001). The nomenclature of the *syntaxa* is in agreement with Weber & al. (2000).

The phytosociological data were processed by means of the software Syntax 2000 (Podani 2000). The chord distance algorithm was adopted to calculate the dissimilarity matrix of the processed relevés . The principal coordinate analysis highlighted clear gradients of variation in the data, correlating with ecological variables. The multivariate analysis was particularly needed because the ecological context of the investigated populations has been deeply disturbed by human activities and marked by large-scale fragmentation. For the biotopes with *G. madoniensis* and *G. aristata* in particular, the phytocenoses showed high levels of floristic and physiognomic variability.

Results

Besides the data available from the literature, our phytosociological investigation contributed to better characterise the communities of *Genista* Sect. *Voglera* in Sicily from the floristic and synecological point of view. While *G. aristata* is an element of cork-oak woods (*Quercus suber*), *G. cupanii* and *G. madoniensis* characterise xerophilous shrubby communities with a pioneer character, with a preminent role in marking the natural landscapes of the open lands Madonie Mts., on siliceous substrata.

***Genisto aristatae-Quercetum suberis* Brullo 1984**

Holotypus: Reléve 7 of table 26 in Brullo (1984).

Characteristis: *Trifolium bivonae*, *Eryngium tricuspidatum* var. *bocconii*, *G. aristata*.

Structure and ecology: mesophilous *Quercus suber* woodlands (Fig. 2), (Tab. 3), in which other oak species often occur (e.g. *Quercus dalechampii*, *Q. congesta*, *Q. ilex*). This associaton is found on loose siliceous substrata (sandy soil, quartz-arenite, Flysh, etc.), from the sea level up to 700 (850) m of altitude. The most mesophilous aspects are

Fig. 2. The typical creeping structure of *Genista aristata* in the undersorey of *Quercus suber*.

found in areas with mean annual precipitation between 750 mm and 850 mm: they are referred to the subassociation *typicum* (Brullo & al. 2008), differentiated by the occurrence of the endemic *G. aristata* (Brullo & Marcenò 1985).

Bioclimate: between the Low Subhumid Thermomediterranean and the Upper Subhumid Mesomediterranean (Bazan & al. 2006).

Syndynamic role: this association is ending the climatophilous series on siliceous substrata, in chain contact with other vegetation series belonging to the *Quercetalia ilicis*. The degradation of this vegetation leads to the development of shrubby formations with *Calicotome infesta*, as well as to the garigue with *Cistus* sp. pl., which in extreme situations can be replaced by ephemeral meadows of *Tuberarietea guttatae*.

Distribution: the subassociation *typicum* is widespread along the Tyrrhenian slopes of northern Sicily, and in particular in the submontane-hilly belt of the Madonie and Nebrodi Mts (Brullo & Marcenò 1985).

Phytosociological role of *G. aristata* in the association: the species is found in the low shrubby layers, with a coverage between 2 and 3. It seems to take advantage from a slight disturbance and dunging by the local livestock (mainly pigs).

***Genistetum cupanii* Pignatti & Nimis 1980**

Holotypus: Reléve 100 of table 11 in Pignatti & al. (1980).

Characteristics: *G. cupanii, Tolpis virgata* subsp. *gussonei, Avenella flexuosa, Allium cupanii.*

Structure and ecology: mesophilous cushion-like vegetation which, besides of *G. cupanii*

Table 3. *Genisto aristatae-Quercetum suberis* Brullo 1984.

Progressive number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**		
Altitude (m)	660	710	640	750	690	640	640	700	630	740	650	630	660	700	730	**Presence**	**Costancy**
Area (m^2)	150	150	200	200	100	300	100	250	200	150	100	100	100	100	100		
Slope (%)	5	10	5	5	10	5	10	5	10	5	5	10	10	5	5		
Exposure	N	N	N	N	N	NO	NE	E	N	NE	N	N	N	N	E		
Number of *taxa*	*54*	*46*	*49*	*47*	*52*	*52*	*46*	*36*	*47*	*45*	*50*	*55*	*54*	*53*	*49*		
Car. Genisto aristatae-Quercetum suberis																	
Genista aristata C. Presl	2	2	1	1	2	2	1	3	3	3	2	1	1	3	2	15	V
Eryngium tricuspidatum var. *bocconei* (Lam.) Fiori	+	+	1	+	+	1	+	1	1	1	1	+	+	+	+	15	V
Trifolium bivonae Guss.	1	+	+	+	1	1	+	1	2	2	+	+	1	+	1	15	V
Car. Sub-all. Quercenion dalechampii																	
Quercus dalechampii Ten.	1	3	2	3	1	2	2	2	2	2	1	1	2	3	3	15	V
Quercus congesta C. Presl	2	3	2	1	1	1	2	2	1	2	1	2	2	3	2	15	V
Drymochloa drymeia (Mertens & W. D. J. Koch) Holub	1	1	1	1	1	.	1	+	2	1	+	1	+	1	1	14	V
Pimpinella anisoides V.Brig.	2	+	+	+	1	.	+	.	+	+	+	2	1	+	+	13	V
Echinops ritro subsp. *siculus* (Strobl) Greuter	1	1	2	1	1	.	.	+	.	+	+	.	+	.	+	10	IV
Symphytum gussonei F.Schultz	.	.	.	.	+	+	.	.	+	+	+	.	+	.	+	7	III
Melittis melissophyllum subsp. *albida* (Guss.) P. W. Ball	.	.	.	.	.	.	+	.	+	+	.	+	.	+	+	6	II
Car. All. Erico-Quercion ilicis																	
Quercus suber L.	3	2	5	2	3	4	4	3	3	3	2	4	3	2	4	15	V
Pulicaria odora (L.) Rchb.	1	1	+	+	+	1	1	2	+	+	1	+	1	+	1	15	V
Melica minuta L.	+	+	1	+	+	1	1	+	1	1	1	1	1	+	+	15	V
Cytisus villosus Pourr.	1	1	1	1	+	1	1	+	+	1	+	+	1	1	1	15	V
Erica arborea L.	1	+	1	1	1	+	1	.	1	1	+	1	1	+	+	14	V
Teucrium scorodonia subsp. *crenatifolium* (Guss.) Arcang.	+	+	+	1	+	+	1	.	.	+	.	1	.	+	1	11	IV
Car. Ord. Quercetalia ilicis and Cl. Quercetea ilicis																	
Carex distachya Desf.	1	2	2	2	2	1	1	+	1	1	1	1	2	1	2	15	V
Rubia peregrina L.	1	1	+	+	+	1	1	+	+	2	1	+	1	+	1	15	V
Ruscus aculeatus L.	+	1	1	1	1	+	+	+	1	2	+	+	1	1	+	15	V

Table 3. continued.

Calicotome infesta subsp. *infesta* (C. Presl in J. & C. Presl) Guss.	2	1	3	1	2	+	1	1	3	2	1	1	4	1	1	15	V
Asparagus acutifolius L.	+	1	1	+	1	+	1	+	1	1	+	1	+	1	1	15	V
Galium laevigatum L.	+	+	1	1	+	+	+	.	+	.	+	1	+	+	+	13	V
Viola alba subsp. *dehnhardtii* (Ten.) W. Becker	+	.	1	.	+	+	1	.	1	+	1	+	1	+	+	12	IV
Quercus ilex L.	.	1	.	1	+	.	.	+	1	+	1	+	1	2	1	11	IV
Pyrus spinosa Forssk.	+	+	1	.	1	.	.	+	.	1	+	.	1	+	+	10	IV
Osyris alba L.	.	+	.	+	+	1	.	.	1	1	1	+	.	+	+	10	IV
Thalictrum calabricum Sprengel	.	1	1	1	+	.	.	.	.	1	1	.	+	+	+	9	III
Rosa sempervirens L.	1	.	.	1	1	+	.	.	1	.	.	1	.	1	+	8	III
Asplenium onopteris L.	+	+	+	+	+	.	.	.	+	.	.	+	+	.	.	8	III
Euphorbia characias L.	+	.	1	.	1	.	1	.	.	.	+	1	1	.	.	7	III
Daphne gnidium L.	+	.	1	.	1	+	+	.	.	.	.	+	.	.	.	6	II
Luzula forsteri (Sm.) DC.	+	.	.	.	+	.	+	.	.	.	+	+	.	+	.	6	II
Cyclamen repandum Sm. in Sibth. & Sm.	.	.	.	+	.	.	+	.	.	+	.	+	+	.	+	6	II
Phillyrea angustifolia L.	.	1	.	1	.	.	.	.	.	.	.	+	.	+	.	4	II
Other species																	
Crataegus monogyna Jacq. var. *monogyna*	+	+	+	2	+	1	+	+	1	1	+	1	+	+	+	15	V
Clinopodium vulgare L.	1	+	+	+	1	+	+	+	1	+	1	+	1	+	+	15	V
Crepis leontodontoides All.	1	1	1	1	+	+	+	+	+	+	+	1	+	+	1	15	V
Dactylis glomerata subsp. *hispanica* (Roth) Nyman	+	1	+	1	1	1	1	1	1	1	+	1	1	+	1	15	V
Anthoxanthum odoratum L.	1	1	1	+	1	+	1	+	+	1	+	1	1	2	+	15	V
Oenanthe pimpinelloides L.	+	+	1	.	+	+	+	1	+	+	1	+	1	+	1	14	V
Prunus spinosa L.	+	1	1	+	+	+	1	.	+	2	1	+	1	+	2	14	V
Rubus ulmifolius Schott	+	+	1	+	+	+	1	.	1	1	1	1	+	+	1	14	V
Carex flacca subsp. *erythrostachys* (Hoppe) Holub	+	1	+	1	1	+	+	.	+	.	+	1	2	1	2	13	V
Brachypodium sylvaticum (Hudson) P. Beauv.	+	.	+	1	.	1	1	+	.	+	+	+	.	1	+	11	IV
Cynosurus cristatus L.	.	+	+	+	+	1	.	+	1	+	+	.	1	+	.	11	IV
Allium subhirsutum L.	+	+	.	+	+	+	.	+	+	.	+	+	+	.	+	11	IV
Cistus monspeliensis L.	+	1	+	.	.	+	+	+	+	+	.	+	1	.	+	11	IV
Origanum vulgare L. subsp. *vulgare*	+	+	+	+	+	.	.	.	+	+	+	.	+	+	+	11	IV
Buglossoides purpurocaerulea (L.) I. M. Johnst.	1	+	.	+	1	+	+	.	.	.	1	+	1	+	+	11	IV
Cistus salvifolius L.	.	+	.	+	.	+	.	+	+	1	+	1	+	1	1	11	IV
Lolium perenne L.	.	.	.	+	+	+	.	+	+	+	.	+	+	+	+	10	IV
Trifolium pratense L. subsp. *pratense*	1	.	+	.	.	1	1	+	.	.	+	+	.	+	+	9	III

Table 3. continued.

Prunella laciniata (L.) L.	+	+	.	+	+	+	+	.	+	.	.	.	.	+	.	8	III
Agrimonia eupatoria L.	+	1	.	.	+	.	+	.	.	+	+	.	+	+	.	8	III
Briza maxima L.	.	.	.	.	.	+	.	+	+	+	.	+	+	+	+	8	III
Urospermum dalechampii (L.) F. W. Schmidt	.	.	.	.	.	+	.	+	+	+	+	.	+	+	+	8	III
Malus sylvestris Miller	+	.	1	.	.	.	1	+	.	.	.	1	.	1	.	6	II
Acer campestre L.	1	.	+	1	.	.	1	.	.	.	.	+	1	.	.	6	II
Achillea ligustica All.	+	.	+	.	.	+	+	.	.	.	.	+	+	.	.	6	II
Poa sylvicola Guss.	+	.	1	.	+	+	.	.	.	.	+	.	.	+	.	6	II
Hypericum perfoliatum L.	.	.	+	.	+	+	+	.	.	.	.	+	.	.	.	5	II
Galium lucidum All.	.	+	.	.	.	.	.	.	+	1	.	+	.	+	.	5	II
Ampelodesmos mauritanicus (Poir.) T. Durand & Schinz	+	.	+	.	.	.	.	.	.	.	.	1	1	.	+	5	II
Hedera helix L.	.	.	.	+	.	.	+	.	+	.	1	.	+	.	.	5	II
Centaurium erythraea Rafin.	+	.	+	.	.	.	+	.	.	.	.	+	.	.	.	4	II
Carlina sicula Ten.	.	+	.	.	.	.	.	.	+	.	.	.	+	+	.	4	II
Pulicaria dysenterica (L.) Bernh.	+	.	.	.	+	.	.	.	.	.	.	+	.	.	.	3	I
Fraxinus ornus L.	.	.	.	+	.	+	.	.	.	.	+	.	.	.	.	3	I
Holcus lanatus L.	+	.	.	.	+	.	.	.	.	.	.	.	.	+	.	3	I
Ranunculus pratensis C. Presl in J. & C. Presl	+	.	.	.	.	+	.	.	.	.	+	.	.	.	.	3	I
Tolpis virgata subsp. sexaristata (Biv.) Giardina & Raimondo	.	.	.	.	.	+	.	.	+	.	.	.	+	.	.	3	I
Reichardia picroides (L.) Roth	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	2	I
Hyoseris radiata L.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	2	I
Tamus communis L.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	2	I
Accidental species	2		2	1		3							1				

Accidental species: *Geranium dissectum* L. (rel. 6); *Potentilla reptans* L. (rel. 1); *Juncus inflexus* L. (rel. 1); *Viscum album* L. (rel. 3); *Epipactis helleborine* (L.) Crantz (rel. 3); *Cynosurus echinatus* L. (rel. 6); *Anisantha sterilis* (L.) Nevski (rel. 13); *Silene vulgaris* (Moench) Garcke subsp. *vulgaris* (rel. 6); *Sherardia arvensis* L. (rel. 4)

Locality and date of the relevés: rel. 1-8 Contrada Mongiarrati, Isnello 20/06/2009 ; rel. 9-15 Bosco Comunale, Castelbuono 16/06/2009.

(Fig. 3), often includes many other species (Tab. 4). It colonizes substrata resulting from the weathering of the geological unit named Numidic Flysch, at altitudes between 1,100 m and 1,700 m a.s.l. The most mesophilous aspects are found in areas with a mean annual precipitation of 1,500 mm.

Bioclimate: between the Upper Mesomediterranean and the Upper Supramediterranean, with an ombrotype between Upper Subhumid and Low Humid (Bazan & al. 2006).

Syndynamic role: the association *Genistetum cupanii* has its primary stands on summit windy slopes, but most of its populations are currently related to the southern acidophilous series of *Anemono apenninae-Fagetum* and to the acidophilous orophilous series of *Ilici aquifolii-Quercetum austrotyrrhenicae*. The destruction of these woods initially favours the secondary shrublands of *Crataegetum laciniatae,* and, as the land degradation goes on, the regression towards *Genistetum cupanii* is enhanced. On flat or gently sloping sites, where soils are not very permeable and periodically grazed, *Genistetum cupanii* shifts into the mesophilous pastures of *Cynosuro-Plantaginetum cupanii*.

Distribution: association exclusively found in the mountain belt of Madonie Mts.

Phytosociological role of *G. cupanii* in the association: the species represents the structural element of a cushion-like vegetation, with cover values between 4 and 5. The pasture, particularly in the past, favoured the spreading *G. cupanii* through the dispersion of its seeds. Seedlings of this species are rarely eaten by animals.

Fig. 3. The peculiar hummock aspect of *Genista cupanii*. In the centre of the picture there is a specimen of *Ilex aquifolium*, shaped by the bites of goats.

Table 4. *Genistetum cupanii* Pignatti & Nimis 1980.

Progressive number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**		
Altitude (m A.M.S.L.)	1025	1085	985	1030	1000	1150	1110	1120	1100	1070	1030	990	1000	1050	1140		
Surface (m^2)	50	100	50	50	50	50	50	25	25	80	100	100	50	50	50		
Slope (%)	18	18	20	20	10	5	20	20	20	18	25	20	10	20	20	**Presence**	**Costancy**
Exposure	N	N	NE	N	NE	S	E	NO	E	NE	N	N	NE	E	N		
Number of *taxa*	*16*	*15*	*15*	*16*	*14*	*14*	*13*	*15*	*14*	*16*	*17*	*15*	*17*	*15*	*17*		
Car. Genistetum cupanii																	
Genista cupanii Guss.	4	4	4	4	4	4	5	4	4	5	4	5	4	4	4	15	V
Tolpis virgata subsp. *gussonei* (Fiori) Giardina & Raimondo	+	.	+	+	.	+	.	+	+	+	+	+	.	.	+	10	IV
Avenella flexuosa (L.) Drejer	.	.	+	.	.	.	.	+	+	+	.	.	+	+	+	7	III
Allium cupanii Raf.	.	.	+	.	+	.	.	.	.	+	.	+	+	.	+	6	II
Car. *Cisto*-Lavanduletalia and -tea																	
Agrostis castellana Boiss. & Reut.	1	+	.	+	1	.	+	+	1	1	+	+	1	.	+	12	IV
Calicotome infesta subsp. infesta (C. Presl in J. & C. Presl) Guss.	.	+	+	+	.	+	.	.	+	.	+	.	.	+	.	7	III
Cynosurus echinatus L.	+	.	.	.	.	.	.	+	.	+	.	.	+	.	+	5	II
Briza maxima L.	.	+	.	.	.	+	.	+	.	.	.	.	+	.	+	5	II
Cistus salvifolius L.	.	.	.	+	.	.	+	.	.	.	+	.	.	.	.	3	I
Aira caryophyllea L. subsp. *caryophyllea*	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1	I
Diff. acidophilous species																	
Anthoxanthum odoratum L.	1	+	+	+	+	.	.	+	+	1	+	+	+	+	+	13	V
Brachypodium pinnatum (L.) Beauv.	+	.	.	+	.	.	+	.	.	+	+	.	.	.	.	5	II
Pteridium aquilinum (L.) Kuhn	.	+	.	.	.	.	+	+	.	.	.	+	.	+	+	6	II

Table 4. continued.

Other species																	
Dactylis glomerata L. subsp. *glomerata*	+	+	+	.	+	+	+	.	+	.	+	+	+	+	+	12	IV
Sedum amplexicaule subsp. *tenuifolium* (Sm.) Greuter	+	+	.	.	+	+	.	+	.	+	.	.	+	+	+	9	III
Festuca circummediterranea Patzke	+	.	+	+	+	.	+	.	+	+	+	+	+	.	.	10	IV
Acinos alpinus (L.) Moench	+	.	+	+	.	.	+	.	+	+	+	+	.	.	.	8	III
Lolium rigidum Gaudin	.	+	+	+	+	.	.	.	+	.	+	.	+	+	.	8	III
Hypochoeris cretensis (L.) Bory & Chaub.	.	+	+	.	+	+	.	.	+	.	.	.	+	+	.	7	III
Hyoseris radiata L.	.	+	.	.	.	+	.	+	.	.	.	.	.	+	+	5	II
Achillea ligustica All.	.	+	.	+	.	.	+	.	.	.	+	+	.	+	.	6	II
Pyrus spinosa Forssk.	+	.	+	.	+	.	.	.	+	+	.	.	+	.	.	6	II
Anthemis cretica subsp. *columnae* (Ten.) Frazén	+	.	.	.	.	+	.	+	.	+	.	+	.	.	+	6	II
Petrorhagia saxifraga subsp. *gasparrinii* (Guss.) Greuter & Burdet	.	.	.	+	.	.	+	.	.	.	+	+	.	.	.	4	II
Rosa sicula Tratt.	+	.	+	.	+	.	.	.	.	+	.	.	+	.	.	5	II
Cynosurus cristatus L.	.	+	.	+	.	.	.	.	.	.	+	.	.	+	.	4	II
Galium scabrum L.	.	.	.	+	.	.	+	.	.	.	+	+	.	.	.	4	II
Avena barbata Pott. ex Link	.	.	.	.	.	+	.	+	.	.	.	.	.	.	+	3	I
Micromeria juliana (L.) Benth. ex Rchb.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	+	3	I
Linum strictum L. subsp. *strictum*	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	2	I
Reichardia picroides (L.) Roth	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	2	I
Accidental species	2	2	2			2	2	1			1						

Accidental species: *Phleum hirsutum Honck.* (rel. 1); *Prunus spinosa* L. (rel. 2); *Silene vulgaris* (Moench) Garcke subsp. *vulgaris* (rel. 1); *Daphne laureola* L. (rel. 6); *Daucus carota* L. subsp. *carota* var. *carota* (rel. 3); *Lepidium hirtum* subsp. *nebrodense* (Raf.) Thell. (rel. 3); *Viola alba* subsp. *dehnhardtii* (Ten.) W. Becker (rel. 6); *Crataegus orientalis* M. Bieb. subsp. *orientalis* (rel. 7); *Trifolium bivonae* Guss. (rel. 7); *Juncus effusus* L. (rel. 8); *Aegilops geniculata* Roth (rel. 11); *Convolvulus cantabrica* L. (rel. 2).

Locality and date of the relevés: rel. 1-8 Contrada Cixè, Geraci Siculo 15/06/2009 ; rel. 9-15 Contrada Pietra Giordano, Geraci Siculo 16/06/2009.

***Cisto salvifolii-Genistetum madoniensis* ass. nova**

Holotypus: Relève 1 of table 5, *hoc loco*.

Characteristics: *G. madoniensis, Cistus salvifolius.*

Structure and ecology: thermoxerophilous garigue (Fig. 4, Fig. 5) dominated by various heliophilous shrubby species, like *Genista madoniensis*, *Lavandula stoechas*, *Cytinus hypocistis*, *Cistus creticus* subsp. *creticus*, and *Erica arborea*. It occurs on Numidic Flysch substrata, at altitudes between 150 m and 600 m a.s.l.. The most xerophilous aspects are found in areas with a mean annual precipitation of around 700 mm.

Bioclimate: between Upper Thermomediterranean and Low Mesomediterranean, with an Upper Dry ombrotype (Bazan & al. 2006).

Syndynamic role: the association *Cisto salvifolii-Genistetum madoniensis* is related to thermophilous cork oak woods in the northern hilly slopes of the Madonie Mts. It develops in areas affected by the degradation of the forest top-soil, in particular due to fires

Distribution: the association is exclusive endemic to the Madonie Mts.

Phytosociological role of *G. madoniensis* in the association: the species largely contributes to form structure of a pioneer shrubby garigue, together with other heliophilous species. On small rocky outcrops it often forms pure, monospecific populations. In agreement with Bartolo & al. (1994), this community has to be included in *Calicotomo-Cistion ladaniferi*, a Tyrrhenian alliance of the class *Cisto-Lavanduletea*.

Discussion

As we have seen, the association *Genisto aristatae-Quercetum suberis* occurs on siliceous substrata in the Madonie Mts. and Nebrodi Mts. Apart from the already men-

Fig. 4. The typical aspect of *Cisto salvifolii-Genistetum madoniensi*s.

Table 5. *Cisto salvifolii-Genistetum madoniensis* ass. nova.

Sampling area No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**		
Altitude (m)	575	570	409	415	420	340	290	450	420	454	469	481	520	450	420	**Presence**	**Costancy**
Square size (m^2)	100	100	100	100	100	200	200	200	200	100	100	100	100	150	200		
Inclination (%)	80	65	30	30	25	25	10	5	40	50	70	20	20	30	20		
Exposition	NW	NW	N	N	N	NE	NE	SW	NE	N	N	N	N	NE	N		
Number of *taxa*	*31*	*23*	*21*	*21*	*31*	*32*	*27*	*43*	*45*	*15*	*15*	*21*	*20*	*34*	*28*		
Car. Cisto salvifolii-Genistetum madoniensis																	
Genista madoniensis Raimondo	4	4	1	1	2	+	+	1	1	3	4	2	3	1	3	15	V
Cistus salvifolius L.	2	3	4	4	4	+	+	1	1	2	1	1	+	1	4	15	V
Car. All. Cistion ladaniferi and Cl. Cisto-Lavanduletea																	
Briza maxima L.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	15	V
Lavandula stoechas L.	1	+	+	+	+	+	+	+	+	+	+	1	+	.	+	14	V
Cytinus hypocistis (L.) L.	+	+	+	+	+	+	+	+	+	+	+	+	+	.	+	14	V
Cistus creticus L. subsp. *creticus*	+	.	1	1	2	.	.	1	1	1	+	+	3	.	1	11	IV
Cistus monspeliensis L.	+	+	.	.	.	.	.	1	1	+	2	1	2	.	+	9	III
Pinus pinea L.	.	.	.	3	2	.	.	.	.	+	1	+	.	.	3	6	II
Aira caryophyllea L. subsp. *caryophyllea*	.	+	+	+	.	.	.	.	+	.	.	.	.	+	.	5	II
Cynosurus echinatus L.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	2	I
Car. All. Erico-Quercion ilicis																	
Erica arborea L.	2	1	2	2	1	3	4	2	1	1	3	3	1	3	2	15	V
Eryngium tricuspidatum var. *bocconii* (Lam.) Fiori	+	+	.	+	+	+	+	+	+	+	+	+	+	.	+	13	V
Arbutus unedo L.	1	.	3	3	1	1	1	+	.	1	1	1	.	2	2	12	IV
Cytisus villosus Pourr.	.	.	+	+	+	.	.	1	1	.	.	.	.	+	1	7	III
Trifolium bivonae Guss.	.	.	.	.	.	+	.	1	+	.	.	.	.	.	.	3	I
Pulicaria odora (L.) Rchb.	.	.	.	.	.	.	+	1	1	.	.	.	.	.	.	3	I
Clinopodium vulgare L.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	2	I
Car. Ord. Quercetalia ilicis and Cl. Quercetea ilicis																	
Quercus suber L.	3	2	3	3	3	3	3	3	3	2	3	4	4	3	3	15	V
Calicotome infesta subsp. *infesta* (C. Presl in J. & C.																	

Table 5. continued.

Presl) Guss.	2	1	1	1	1	1	1	+	1	1	1	1	2	.	1	14	V
Rubia peregrina L.	.	.	+	+	+	.	.	+	+	.	.	+	1	+	+	9	III
Lonicera etrusca Santi	+	+	+	+	+	.	.	.	.	.	.	1	+	1	+	9	III
Daphne gnidium L.	+	+	+	+	+	.	.	+	.	.	.	1	.	1	+	9	III
Quercus virgiliana (Ten.) Ten.	+	+	.	.	+	1	.	1	1	.	.	.	1	.	+	8	III
Osyris alba L.	+	+	1	1	+	.	.	.	.	.	.	.	.	.	1	6	II
Cyclamen repandum Sm. in Sibth. & Sm	.	.	.	.	.	+	+	.	+	.	.	.	.	+	.	4	II
Smilax aspera L.	.	.	.	.	.	+	.	.	.	.	.	.	+	+	.	3	I
Fraxinus ornus L.	.	.	.	.	.	.	1	+	.	.	.	.	.	+	.	3	I
Viola alba subsp. *dehnhardtii* (Ten.) W.Becker	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	2	I
Thalictrum calabricum Spreng.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	2	I
Tamus communis L.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	2	I
Rubus ulmifolius Schott	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	2	I
Quercus ilex L.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	2	I
Phillyrea latifolia L.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	2	I
Myrtus communis L.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	2	I
Cyclamen hederifolium Aiton	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	2	I
Asplenium onopteris L.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	2	I
Asparagus acutifolius L.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	2	I
Pyrus spinosa Forssk.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	I
Prasium majus L.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	I
Pistacia lentiscus L.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	1	I
Luzula forsteri (Sm.) DC.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	I
Lonicera implexa Aiton	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	I
Euphorbia characias L.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	1	I
Other species																	
Ampelodesmos mauritanicus (Poir.) T. Durand & Schinz	2	1	.	.	+	+	+	1	1	+	+	1	1	2	2	13	V
Tetragonolobus biflorus (Desr.) Ser. in DC.	+	.	+	+	+	.	.	.	+	+	.	+	+	+	.	9	III
Orobanche variegata Wallr.	+	+	+	+	+	.	.	.	.	.	.	.	+	+	+	8	III
Urospermum dalechampii (L.) F.W. Schmidt	+	+	+	+	.	.	.	+	.	.	.	.	.	+	.	6	II
Lathyrus aphaca L.	+	+	.	.	.	+	.	+	.	.	+	+	.	.	.	6	II
Geranium robertianum L.	.	.	.	.	.	+	+	+	+	.	.	.	.	.	.	4	II
Anthoxanthum odoratum L.	.	.	.	.	+	.	.	+	+	.	.	.	.	1	.	4	II
Trifolium stellatum L.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	+	4	II

Table 5. continued.

Pinus pinea L. - pltantule	+	+	.	.	+	.	.	.	.	.	.	.	.	.	1	4	II
Geranium robertianum L.	+	+	+	.	.	.	.	.	.	.	.	.	.	+	.	4	II
Bellardia trixago (L.) All.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	+	3	I
Biscutella maritima Ten.	.	.	.	.	+	.	.	1	+	.	.	.	.	.	.	3	I
Carlina sicula Ten.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	2	I
Crataegus monogyna Jacq. var. *monogyna.*	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	2	I
Crepis vesicaria L.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	2	I
Dactylis glomerata L. subsp. *glomerata*	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	2	I
Daucus carota L. subsp. *carota* var. *carota*	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	2	I
Emerus major Mill. subsp. *major*	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	2	I
Geranium dissectum L.	.	.	.	.	.	+	.	+	+	.	.	.	.	.	.	3	I
Hypericum perforatum L. subsp. *perforatum*	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	2	I
Ornithopus compressus L.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	2	I
Oxalis pes-caprae L.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	2	I
Scorzonera undulata subsp. *deliciosa* (Guss.) Maire	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	2	I
Sedum stellatum L.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	2	I
Sherardia arvensis L.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	2	I
Trifolium angustifolium L.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	+	3	I
Trifolium pratense L. subsp. *pratense*	.	.	.	.	.	+	+	1	.	.	.	.	.	.	.	3	I
Vicia villosa subsp. *varia* (Host) Corb.	.	.	.	.	.	+	.	+	+	.	.	.	.	.	.	3	I
Accidental species	2					2	2	5	6			1	1	8	2		

Accidental species: *Aira caryophyllea* L. subsp. *caryophyllea* (rel. 14); *Allium subhirsutum* L. (rel. 9); *Anagallis arvensis* L. (rel. 9); *Arum italicum* Mill. (rel. 8); *Bellis annua* L. (rel. 7); *Bellis perennis* L. (rel. 6); *Brachypodium sylvaticum* (Huds.) P. Beauv. (rel. 14); *Cardamine hirsuta* L. (rel. 9); *Cardamine hirsuta* L. (rel. 15); *Coleostephus myconis* (L.) Rchb. fil. in Rchb. & Rchb. fil. (rel. 9); *Convolvulus elegantissimus* Mill. (rel. 7); *Crepis leontodontoides* All. (rel. 1); *Cynosurus cristatus* L. (rel. 14); *Eryngium campestre* L. (rel. 14); *Filago gallica* L. (14); *Galium aparine* L. (rel. 14); *Geranium rotundifolium* L. (rel. 9); *Gladiolus italicus* Mill. (rel. 14); *Hyoseris radiata* L. (rel. 8); *Lotus ornithopodioides* L. (rel. 1); *Medicago murex* Willd. (rel. 8); *Melilotus sulcatus* Desf. (rel. 12); *Oenanthe pimpinelloides* L. (rel. 14); *Polypodium vulgare* L. (rel. 13); *Pulicaria dysenterica* (L.) Bernh. (rel. 15); *Scolymus hispanicus* L. (rel. 6); *Silene gallica* L. (rel. 8); *Trifolium arvense* L. (rel. 9); *Umbilicus rupestris* (Salisb.) Dandy in Ridd. (rel. 8).

Locality and date of the relevés: rel. 1-8 Contrada Sellitta, Gratteri, 30/06/2009; rel. 9-15 07/07/2009 Contrada Zubbio Pollina.

Fig. 5. *Genista madoniensis* on rocky substrata in a wood of *Quercus suber*, in which it often takes on a typical elongated structure.

tioned oak species, many chief species of the order *Quercetalia ilicis* and the class *Quercetea ilicis* are well represented: *Carex distachya*, *Rubia peregrina*, *Calicotome infesta*, *Ruscus aculeatus*, *Asparagus acutifolius*, *Luzula forsteri*, *Asplenium onopteris*, *Rosa sempervirens*, *Osyris alba*, *Galium laevigatum*, *Thalictrum calabricum*, etc.

In the summit area of Nebrodi Mts, between 1,400 m and 1,500 m a.s.l. *G. aristata* characterizes as well the *Genisto-Potentilletum calabrae*, a rangeland association belongingto the class *Molinio-Arrhenatheretea*.

The *Genistetum cupanii* is an association with open structure, characterizing the quartzarenites of Madonie Mts. between 1,100 m and 1,700 m a.s.l. This association is often connected to the degradation of acidophilous deciduous woodsThis and in particular of the association *Ilici-Quercetum austrothyrrenicae* corrected, and of the association *Anemono apenninae-Fagetum*.

The shrub formations with *G. madoniensis* have been eferred to the new association *Cisto salvifolii-Genistetum madoniensis* a very distinctive garigue characterized by the occurrence, and often by the dominance of *G. madoniensis*, which differs from the other two surveyed *Genista* species not only in having much more thermo-xerophilous preferences, but also for its relatively erect habitus.

The ecological autonomy of the new association is confirmed by the dendrogram (Fig. 6), where three main groups can be seen, corresponding to the above-mentioned associations.

Cluster A refers to the relevés of the association *Cisto salvifolii-Genistetum madoniensis*; cluster B includes those of the association *Genisto aristatae-Quercetum suberis*, and cluster C those of the association *Genistetum cupanii*. Similar results arise from the principal coordinate analysis (Fig. 7), which confirms the remarkable floristic differentiation of the three surveyed associations, which have little species in common. These results are also in agreement with Marino & al. (2012).

Within the class *Cisto-Lavanduletea*, the association *Cisto salvifolii-Genistetum madoniensis* has various ecological and structural similarities to some others ones in Spain, like *Rosmarino-Cistetum ladaniferi genistetosum hirsutae* Rivas-Martinez 1968 (Rivas-Martìnez 1970) and *Genisto hirsutae-Cistetum ladaniferi*, rather than to the neighbouring association *Genistetum cupanii*.

In this context, *G. hirsuta* subsp. *hirsuta* can be therefore seen considered as a geographic vicariant of *G. madoniensis*.

Syntaxonomical scheme

QUERCETEA ILICIS Br.-Bl. ex A. e O. Bolos 1950
Quercetalia ilicis Br.-Bl. ex Molinier 1934 em. Rivas-Martinez 1975
Erico arboreae-Quercion ilicis Brullo, Di Martino & Marcenò 1977

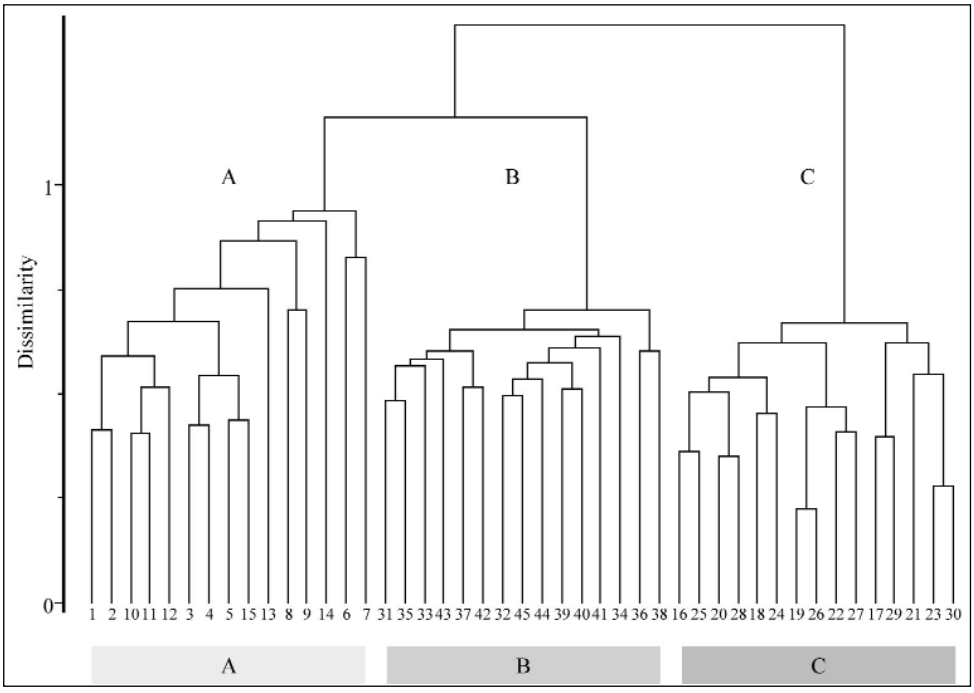

Fig. 6. Cluster analysis of the formation of *Genista* section *Voglera*. A: *Cisto salvifolii-Genistetum madoniensis*; B: *Genisto aristatae-Quercetum suberis*; C: *Genistetum cupanii*.

Quercenion dalechampii Brullo 1984
Genisto aristatae-Quercetum suberis Brullo 1984
subass. *typicum*

RUMICI-ASTRAGALETEA SICULI Pignatti & Nimis in Pignatti & al. 1980 em. Mucina 1997
Erysimo-Jurinetalia bocconei Brullo 1984
Armerion nebrodensis Brullo 1984
Genistetum cupanii Pignatti S. & Nimis in Pignatti E. & S., Nimis & Avanzini 1980

CISTO-LAVANDULETEA Br.-Bl. in Br.-Bl. Molinier & Wagner 1940
Lavanduletalia stoechadis Br.-Bl. In Br.-Bl., Molinier & Wagner 1940 em. Rivas-Martínez 1968
Calicotomo-Cistion ladaniferi Br.-Bl. (1931) 1940
Cisto salvifolii-Genistetum madoniensis ass. nova

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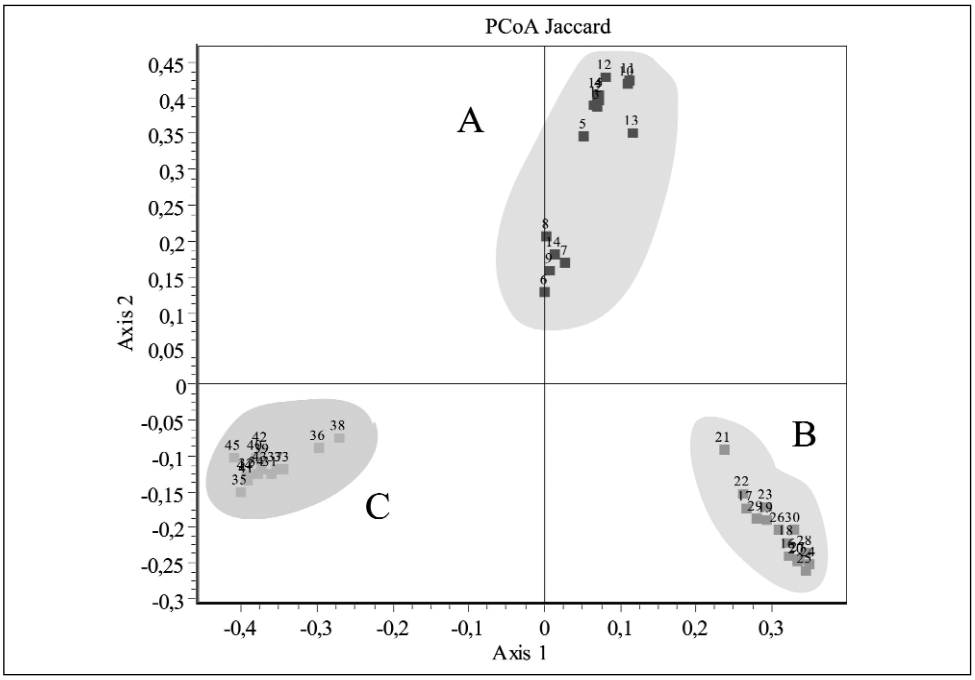

Fig. 7. Diagram obtained from the ordering of the relevés through a principal coordinate analysis performed by the Jaccard similarity index (A: *Cisto salvifolii- Genistetum madoniensis*; B: *Genisto aristatae-Quercetum suberis*; C: *Genistetum cupanii*).

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