

A contribution towards the knowledge of semideciduous and evergreen woods of Apulia (south-eastern Italy)

E. Biondi¹, S. Casavecchia¹, V. Guerra¹, P. Medagli², L. Beccarisi² & V. Zuccarello²

¹Dipartimento di Scienze Ambientali e delle Produzioni Vegetali, Università Politecnica delle Marche, Via Brecce Bianche, I - 60131 Ancona; e-mail: e.biondi@univpm.it

²Dipartimento di Scienze e Tecnologie Biologiche ed Ambientali, Università degli Studi di Lecce, Via Provinciale Lecce-Monteroni, I - 73100 Lecce; e-mail: zuc@unile.it

Abstract

The subject of the present research is the phytosociological study of some typologies of semideciduous and evergreen wood vegetation of the Apulia region, in the south-east of peninsular Italy. The associations, which have been defined on the basis of 152 phytosociological relevés and elaborated by cluster analysis methods, are: the Aleppo pine woods (*Thymo capitati-Pinetum halepensis* and *Cyclamino hederifolii-Pinetum halepensis* ass. nova), the cork oak woods, which in Apulia find the eastern limits of their distribution (*Carici halleranae-Quercetum suberis* ass. nova), the kermes oak shrubbery (*Arbuto unedi-Quercetum calliprini*) and woods (*Hedero heliis-Quercetum calliprini* ass. nova), the holm oak woods, which represent the major vegetational potentiality of the region (*Cyclamino hederifolii-Quercetum ilicis*, *Cephalanthero longifoliae-Quercetum ilicis* and *Festuco exaltatae-Quercetum ilicis*), the Trojan oak woods, which find the western limits of their distribution in the area of Murge, between Apulia and Basilicata (*Euphorbio apii-Quercetum trojanae* and *Teucro siculi-Quercetum trojanae*), and the woods of *Quercus virgiliana* (*Irido collinae-Quercetum virgiliana* ass. nova and *Cyclamino hederifolii-Quercetum virgiliana* ass. nova) and of *Quercus dalechampii* (*Stipo bromoidis-Quercetum dalechampii* ass. nova). Finally, the complete syntaxonomic scheme of the forest vegetation of Apulia is presented.

Keywords: Apulia, evergreen woods, phytosociology, *Quercus-Fagetalia*, *Quercetalia ilicis*, semideciduous woods, synchronology, syntaxonomy.

Riassunto

Contributo alla conoscenza dei boschi sempreverdi e semicaducifogli della Puglia (Italia sud-orientale). Oggetto del presente lavoro è lo studio fitosociologico di alcune tipologie di vegetazione boschiva, sempreverde e semicaducifogli, della regione Puglia, nell'Italia peninsulare sud-orientale. Le associazioni individuate sulla base di 152 rilievi fitosociologici, elaborati con programmi di cluster analysis, riguardano: pinete a pino d'Aleppo (*Thymo capitati-Pinetum halepensis* e *Cyclamino hederifolii-Pinetum halepensis* ass. nova), boschi di sughera, che trovano in Puglia il limite orientale del proprio sinareale (*Carici halleranae-Quercetum suberis* ass. nova), macchie a quercia spinosa (*Arbuto unedi-Quercetum calliprini*) e boschi della stessa specie (*Hedero heliis-Quercetum calliprini* ass. nova), boschi di leccio, rappresentanti la maggiore potenzialità vegetazionale della regione, (*Cyclamino hederifolii-Quercetum ilicis*, *Cephalanthero longifoliae-Quercetum ilicis* e *Festuco exaltatae-Quercetum ilicis*), boschi di fragno, che trovano il limite occidentale del loro sinareale nella zona delle Murge, tra Puglia e Basilicata (*Euphorbio apii-Quercetum trojanae* e *Teucro siculi-Quercetum trojanae*), boschi di quercia virgiliana (*Irido collinae-Quercetum virgiliana* ass. nova e *Cyclamino hederifolii-Quercetum virgiliana* ass. nova) e a quercia di Dalechamp (*Stipo bromoidis-Quercetum dalechampii* ass. nova). Da ultimo viene presentato lo schema sintassonomico completo della vegetazione forestale della Puglia.

Parole chiave: boschi semicaducifogli, boschi sempreverdi, fitosociologia, Puglia, *Quercetalia ilicis*, *Quercus-Fagetalia*, sincronologia, sintassonomia.

Introduction

The general picture of the phytosociological knowledge of the Apulian forest vegetation appears incomplete and fragmentary not just because of the lack of specific studies, but also for the multiplicity of the environmental situation and for the increasing rarity of some of its vegetation typologies, which have been considerably compromised by the actions of man. The aim of the present research is the phytosociological study of some typologies of semideciduous and evergreen wood vegetation referable to the *Quercetalia ilicis* and *Quercus-Fagetalia* classes. The need for a deeper knowledge of these vegetation typologies of Apulia became evident during the analyses carried out for the realization of the national project "Completamento delle

conoscenze naturalistiche di base" (Completion of Base Ecological Information in Italy) which is financed by the Ministry of the Environment and coordinated by Prof Carlo Blasi of the "La Sapienza" University of Rome.

The research also falls within a more general contribution towards the syntaxonomic knowledge of the Italian forest phytocoenoses, addressing the revision of these vegetation typologies that has already been started through previous contributions regarding the holm oak woods of peninsular Italy (Biondi *et al.*, 2003) and of Sardinia (Bacchetta *et al.*, 2003) and the mesophilous woods of the *Fagetalia sylvaticae* order (Biondi, Casavecchia *et al.*, 2002). Moreover, this research is part of the much larger project for the syntaxonomic definition of the vegetation of central-

western Europe (Biondi, Géhu, Grabherr, Pott & Rivas-Martinez, in progress).

On the basis of the European chorological interpretation (Rivas-Martinez *et al.*, 2001), Apulia is part of the Adriatic Province. This extends across the two shores of the Adriatic Sea and part of those of the Ionic Sea, with Apulia forming almost all of its Apulian subprovince. In effect, the vegetational and floristic links between Apulia and the eastern part of this same province are very strong (Francini-Corti, 1966; 1967), as has clearly emerged also during the present study.

Apulia is the most eastern region of Italy and has mainly Mediterranean bioclimatic characteristics (Fig. 1). The regional territory is almost completely isolated from the Apennine chain in that it has only a marginal portion in common, represented by the Daunian mountains, within which the highest peaks of the region are found (Mount Cornacchia, 1151 m). The other heights of the region are the Gargano promontory (Mount

Calvo, 1056 m), the high-plains of the Murge (Mount Caccia, 679 m) and the Serre Salentine (199 m). Between Gargano and the Murge there is the Tavoliere, the second largest plain in Italy (4,000 km²). The region is bathed by the Adriatic Sea in the east and by the Ionic Sea in the south. It has 784 km of coastline, the greatest length of all the regions of the Italian peninsula.

Materials and Methods

From 2000 to 2003, the authors of the present study carried out 152 phytosociological relevés of deciduous and evergreen woods in the Apulia region (see Appendix) that have been summarised as a matrix that altogether includes 352 species. After the conversion of the phytosociological codes into quantitative values (Van der Maarel, 1979), the phytosociological relevés were classified by the average linkage algorithm

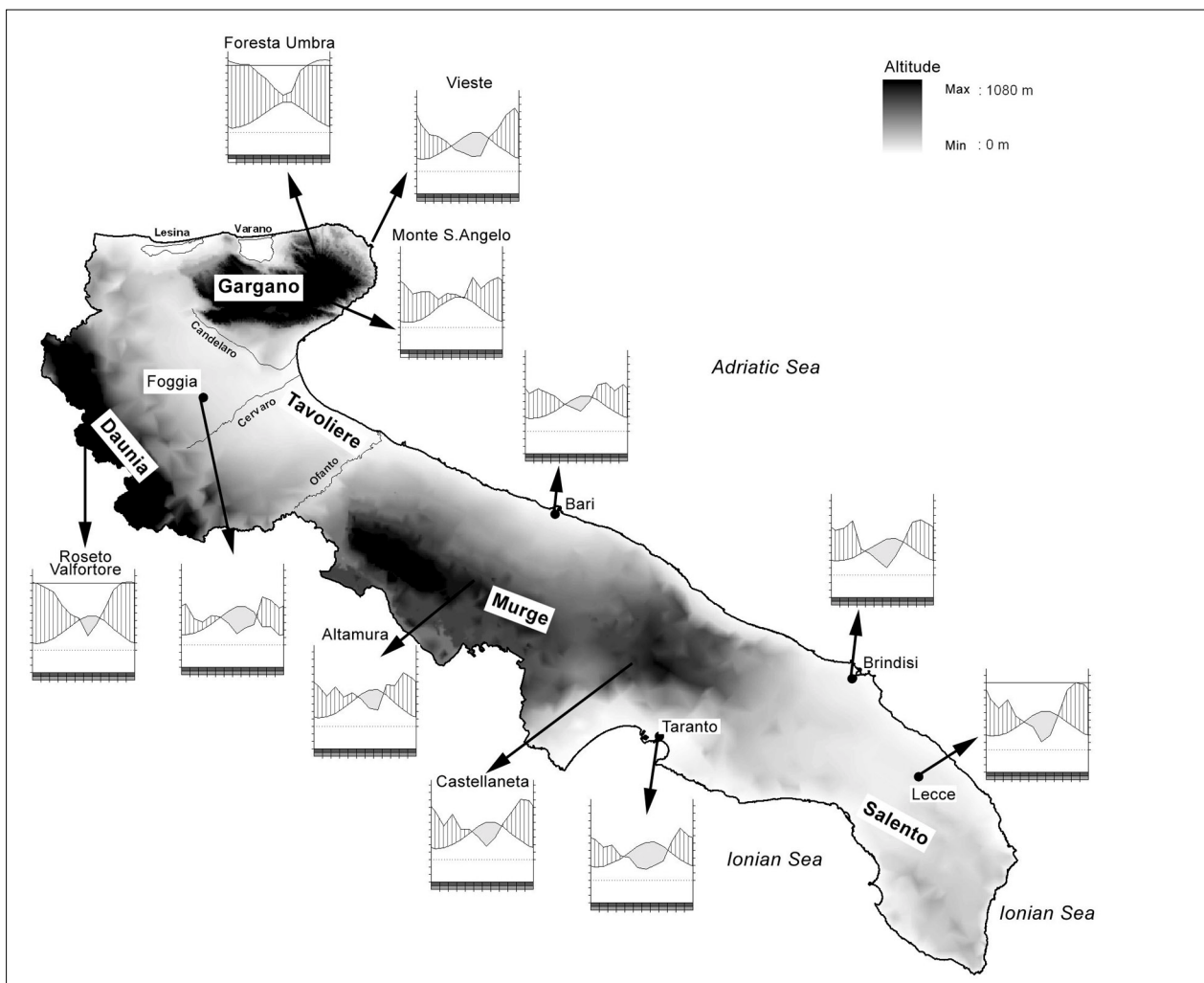


Fig. 1 - Geographical and bioclimatic characteristics of Apulia

(Anderberg, 1973) on the basis of the similarity ratio matrix between relevées (Westoff & Van der Maarel, 1978). In the initial matrix, as illustrated in the dendrogram of Fig. 2, two outgroups have been inserted that represent relevées of elm and turkey oak woods of Apulia that have not been further analysed here, but that have allowed a better discrimination of the vegetation under study.

Results and Discussion

The classification of the relevées on the basis of the dendrogram (Fig. 2) shows three main clusters of relevées: cluster A, which refers to a small group of relevées of early phytocoenoses with a dominance of *Ulmus minor* representing the first outgroup; cluster C, which includes instead the phytocoenoses with a dominance of *Quercus cerris* representing the second outgroup; while cluster B, which includes the relevées that are the subject of the present study, is further subdivided into seven subclusters that are referable to the same number of wood typologies: (a) the Aleppo pine woods; (b) the cork oak woods; (c) the kermes oak

woods and shrubberies; (d) the holm oak woods; (e) the *Quercus dalechampii* woods; (f) the *Quercus virgiliana* woods and (g) the Trojan oak woods.

The Aleppo pine woods

There are contrasting opinions of the indigenesness problem of the pine woods of *Pinus halepensis* even though many authors agree that some coastal pine woods of the Gargano promontory and of the Tremiti Islands, and part of those of the inland Taranto territory, are autochthonous (Francini, 1953; Magini, 1955; Agostini, 1967; De Marco *et al.*, 1984; De Marco & Caneva, 1984). The coastal pine woods are referred to the associations *Pistacio-Pinetum halepensis*, described for the Island of San Domino (in the Tremiti Islands) and found also in Gargano, and *Plantago albicans-Pinetum halepensis*, of the coastal dunes of the Ionic arc. During the present studies, other typologies were investigated that are referred to the associations: *Thymo capitati-Pinetum halepensis* and *Cyclamino hederifolii-Pinetum halepensis*. The potential distribution of the Apulian pine woods is illustrated in Fig. 3.

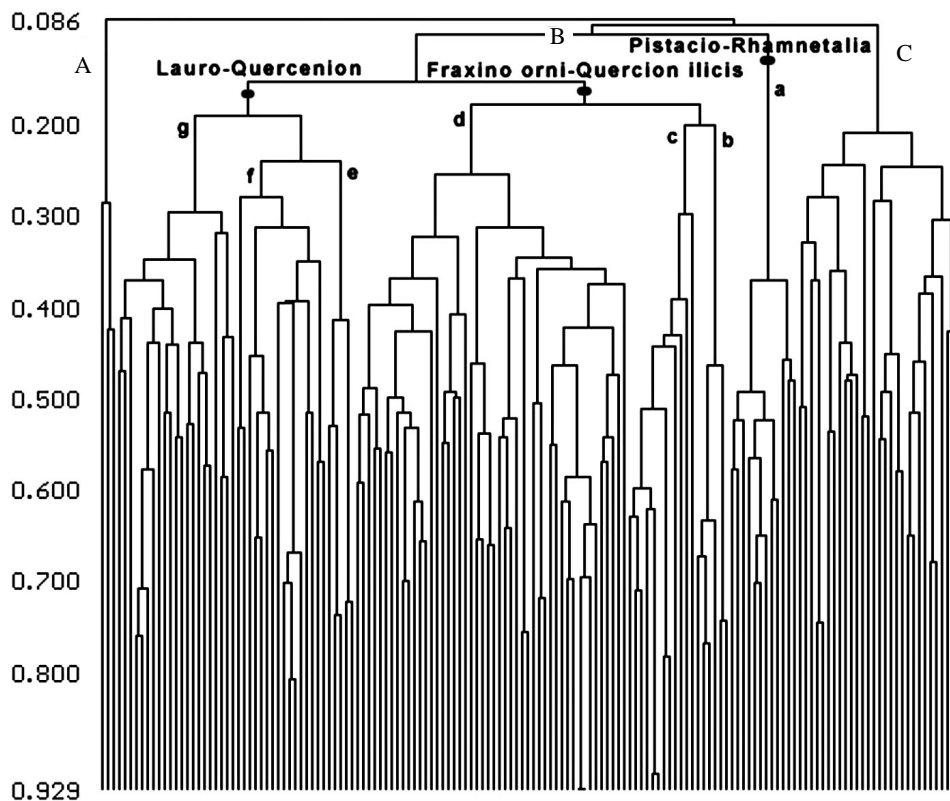


Fig. 2 - Classification of the relevées of the Apulian woods

THYMO CAPITATI-PINETUM HALEPENSIS De Marco & Caneva 1984

(rels. n. 1-3 of Tab. 1)

thymetosum striati Bartolo, Brullo, Minissale & Spampinato 1985

CYCLAMINO HEDERIFOLII-PINETUM HALEPENSIS ass. nova

(type rel. n. 9 of Tab. 1)

The inland pine woods of the Ionic sector of the Taranto Murge area develop in territories with a substratum of limestone and calcareous sandstones that are cut longitudinally by long and deep canyons, known as “gravine”. The pine woods have the potential to develop both on the summit plateaux and along the slopes of the warmer “gravine” (in the “Gravina del Triglio”, near Statte, on the Cretaceous calcareous substrata, along deep and open bends and in the “Gravina di Alezza” and “Gravina di l’Amastuola”, near Crispiano, on Pliocene calcareous sandstone along the sunniest sectors overhanging the flood-river bed).

The pine woods of the plateaux have been attributed to the subhumid, Thermomediterranean basophilous *Thymo capitati-Pinetum halepensis* association, differentiated by some species with an eastern distribution, such as *Thymus capitatus*, *Tremastelma palaestinum* and *Globularia alipum*. Moreover, for the pine woods of the inland Taranto areas, the *thymetosum striati* subassociation, differentiated by *Thymus striatus* and *Hippocrepis glauca*, has been indicated. These pine woods, influenced by cutting, by repeated fires and by

pasturing, have an open structure that favours the penetration of a rich variety of chamaephytic species of the *Cisto-Micromerietea* class. For this reason, in a later syntaxonomic revision of the Italian pine woods, Bartolo *et al.* (1985) included this association in the *Cisto-Ericion* alliance and in the *Cisto-Ericetalia* order.

In the “gravine”, mainly on the warmer aspects at altitudes between 80 and 250 m, the floristic characteristics of the spontaneous woods of *Pinus halepensis* change considerably, such that they can be considered to be different from those just described, in that they are more mesophilous and have a significant presence of nemoral species (Tab. 1). This vegetation is referred to the new dry, Thermomediterranean association that penetrates into the subhumid, Mesomediterranean bioclimatic belt: *Cyclamino hederifolii-Pinetum halepensis*, of which the characteristic and differential species are considered to be: *Pistacia terebinthus*, *Cyclamen hederifolium*, *Asyneuma limonifolium*, *Osyris alba*, *Crataegus monogyna*, *Carex distachya*, *Hippocrepis emerus* ssp. *emeroides* and *Quercus ilex*.

It is thought that the two Aleppo pine wood associations can be referred to the *Oleo-Ceratonion* alliance and to the *Pistacio-Rhamnetalia alaterni* order, as was proposed previously for all of the pine woods with climatophilous characters of southern Italy (De Marco & Caneva, 1984).

The cork oak woods

A species with a western Mediterranean distribution, *Quercus suber* finds in Apulia the eastern limit of its main distribution area, with some woods of limited size concentrated in the central-southern sector of the region (Fig. 4). According to the published testimony (Crivellari, 1950), in the past the cork oak woods were much more numerous and bigger than now, although already in the 1950s there were lamentably large reductions due to the conversion of the wooded areas to farmlands (Tormen, 1953). In the Brindisi Murge area, there are today woods of reasonable size near Tutturano (“Bosco di Santa Teresa”) and near Mesagne (“Bosco Preti” and “Bosco I Lucci”).

There is disagreement with regards to the endogenousness of the Apulia cork oak woods, even if some authors agree that they

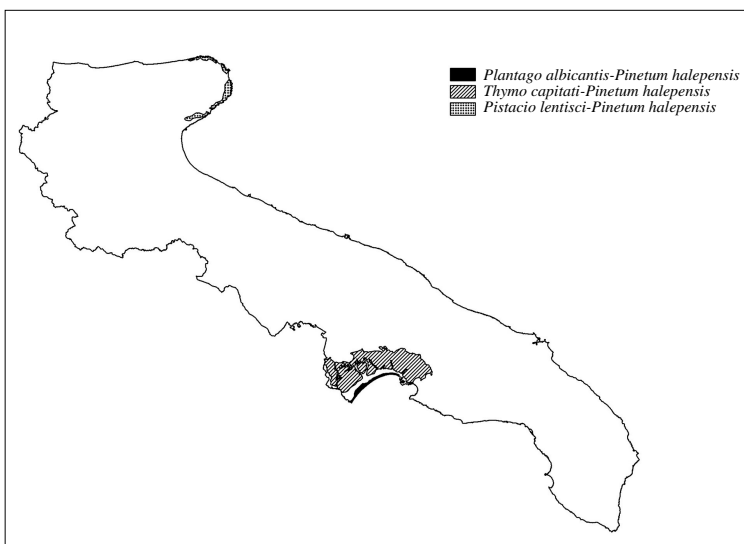


Fig 3 - Potential distribution area of the pine woods

Tab. 1 - *Thymo capitati-Pinetum halepensis* De Marco & Caneva 1984 (rel. 1-3)
thymetosum striati Bartolo, Brullo, Minissale & Spampinato (rel.2-3)
Cyclamino hederifolii-Pinetum halepensis ass. nova (rel.4-12)

Rel. n.	1	2	3	4	5	6	7	8	9*	10	11	12	P
Altitude (m)	110	120	165	211	125	87	130	145	120	165	150	125	r
Exposure	-	SSE	NNE	WNW	ENE	E	NNW	NNW	E	NNE	NNW	E	e
Slope (°)	-	5	4	25	15	30	23	26	30	15	24	30	s.
High of the tree layer (m)	10	8	7	8-10	8-10	10	12	10	10	15	12	6	
Coverage (%)	80	90	75	90	90	75	80	85	90	85	75	100	
Area (m ²)	100	200	250	300	250	200	160	180	100	190	190	300	
Charact. and diff. species of the <i>Thymo capitati-Pinetum halepensis</i> ass.													
Thymus capitatus (L.) Hofm. et Lk.		+	+	1.2	.	.	.	.	.	.	.	.	3
Tremastelma palaestinum (L.) Janchen		+	+	.	+	.	.	.	.	.	.	.	3
Diff. species of the <i>thymetosum striati</i> subass.													
Hippocrepis glauca Ten.		.	+	+2	.	.	.	.	.	+2	.	.	3
Thymus striatus Vahl		.	.	+	.	.	.	+	.	.	.	.	2
Charact. and diff. species of the <i>Cyclamino hederifolii-Pinetum halepensis</i> ass.													
Pistacia terebinthus L.		.	.	+	+	.	1.2	.	+	1.2	1.1	+	.
Hippocrepis emerus (L.) Lassen ssp. emeroides (Boiss. et Spruner) Lassen		.	.	.	+	+	+2	.	2.3	2.3	1.3	.	1.2
Cyclamen hederifolium Aiton		.	.	.	+2	1.2	2.2	+2	+2	1.2	.	.	6
Asyneuma limonifolium (L.) Janchen		.	.	+	.	.	.	+	+	+	.	.	(+)
Crataegus monogyna Jacq.		.	.	.	.	.	.	+	+	.	+	+	4
Charact. and diff. species of the <i>Oleo-Ceratonion</i> all., the <i>Pistacio-Rhamnetalia alaterni</i> order and the <i>Quercetea ilicis</i> class													
Pinus halepensis Mill.	4.4	5.5	3.2	5.4	5.5	5.5	4.3	3.3	4.4	5.4	4.2	3.3	12
Olea europaea L. var. sylvestris Brot.	+	+	+2	+	+	+	1.1	1.1	2.2	1.2	+	2.3	12
Asparagus acutifolius L.	1.2	+	+	2.2	1.2	1.2	+2	1.2	1.2	+2	+2	1.2	12
Prasium majus L.	+	1.1	+	2.2	+	1.2	2.2	2.2	1.2	1.2	1.2	2.2	12
Pistacia lentiscus L.	.	1.2	2.2	3.3	3.3	3.2	3.2	4.2	4.4	2.2	2.2	4.5	11
Allium subhirsutum L.	+2	.	+	1.2	+2	1.2	+2	+2	1.1	+	+	1.2	11
Rubia peregrina L. var. longifolia Poir.	.	.	.	1.2	+2	1.2	+2	1.2	1.2	+	+2	1.2	9
Melica arrecta O. Kuntze	.	.	.	2.2	.	+	1.2	+2	.	+2	1.2	+2	7
Rhamnus alaternus L.	.	.	.	.	.	.	+	+	4.5	+	1.1	2.2	6
Lonicera implexa Aiton	.	.	+	.	.	+	+2	+2	1.2	+2	.	.	6
Carex distachya Desf.	.	.	+2	.	.	.	+2	+2	+2	.	+2	1.2	6
Osyris alba L.	.	.	.	.	.	.	1.2	+	.	+	+	+2	5
Phillyrea latifolia L.	.	.	+	.	.	2.2	+	+2	1.2	+	.	.	5
Daphne gnidium L.	.	.	+	.	.	.	+	+	.	+	+	.	5
Quercus ilex L.	.	.	.	.	.	1.1	+	.	1.2	.	.	+	4
Myrtus communis L.	.	.	.	.	.	2.2	+	+	+	.	.	.	4
Phillyrea media L.	.	.	+	.	.	.	+	.	.	.	1.1	2.2	4
Stipa bromoides (L.) Doerfl.	.	.	+	+	.	+	.	.	+	.	.	.	4
Smilax aspera L.	.	.	.	.	.	.	+	.	.	.	.	+2	2
Juniperus oxycedrus L. ssp. macrocarpa (S. et S.) Ball	.	.	.	.	.	.	.	1.1	1.2	.	.	.	2
Ceratonia siliqua L.	.	.	.	.	.	.	.	.	1.2	.	.	+2	2
Teucrium flavum L. ssp. flavum	.	.	.	.	.	.	.	.	+	.	.	+2	2
Carex hallerana Asso	.	.	.	1.2	.	.	.	.	.	.	.	.	1
Rosa sempervirens L.	.	.	.	.	.	.	.	.	+	.	.	.	1
Ruscus aculeatus L.	.	.	.	.	.	.	.	.	+	.	.	.	1
Charact. and diff. species of the <i>Cisto cretici-Ericetalia manipuliflorae</i> order and the <i>Cisto cretici-Micromerietea julitanae</i> class													
Cistus monspeliensis L.	1.2	.	1.2	.	.	.	+	+	.	+2	+2	+	7
Rosmarinus officinalis L.	+	2.3	1.2	.	.	.	.	+	.	1.2	+	+2	7
Micromeria graeca (L.) Benth	.	.	+	+	.	.	.	+	.	+	+	.	5
Cistus creticus L. ssp. creticus	+2	.	+	.	.	.	.	.	.	(+)	+	+	5
Teucrium polium L.	.	+	+2	.	.	.	.	+2	.	.	+	.	4
Phagnalon saxatile (L.) Cass.	+	+	.	+2	.	.	.	.	.	.	.	.	3
Dorycnium hirsutum (L.) Ser.	.	.	+	+	.	.	.	.	.	+	.	.	3
Satureja cuneifolia Ten.	1.2	.	1.2	+	.	.	.	.	.	.	.	.	3
Helianthemum jonium Lacaita	.	+	+	.	.	.	.	.	.	.	.	.	2
Cistus salvifolius L.	.	1.2	.	.	.	.	.	.	.	.	.	.	1
Cistus creticus L. ssp. eriocephalus	.	.	.	+	.	.	.	.	.	.	.	.	1
Fumana thymifolia (L.) Spach	+	.	.	.	.	.	.	.	.	.	.	.	1
Other species													
Urginea maritima (L.) Baker	+	.	+	1.2	+	+	1.1	+	1.1	+	+	1.1	11
Oryzopsis miliacea (L.) Asch et Schweinf.	+2	1.2	+2	1.2	+2	+2	+2	+	.	+2	1.2	.	10
Geranium purpureum Vill.	.	.	.	.	+2	+2	+	.	.	+	+	1.1	7
Reichardia picroides (L.) Roth	+2	+	+	+	.	.	+	+	.	.	+	.	7
Convolvulus elegantissimus Miller	.	+2	+	.	.	.	+	+	+	+	+	.	7
Crepis vesicaria L.	.	.	.	+2	.	.	+	+	.	+	+	.	5
Lagurus ovatus L.	.	+2	+2	+2	.	.	.	+	.	.	+2	.	5
Parietaria diffusa M. et K.	.	.	.	.	+2	+2	.	.	1.2	.	+	.	4
Brachypodium distachyum (L.) Beauv.	.	.	.	.	.	+	.	+2	.	+	+2	.	4
Melica transylvanica Schur	.	.	+2	.	.	+	.	.	.	.	+	.	4
Briza maxima L.	.	.	+	+	.	.	(+2)	.	.	.	+2	.	4
Daucus carota L.	+	.	+	.	.	.	+	.	.	.	.	.	3
Stachys germanica L.	.	.	.	.	.	.	+	+	.	.	+	.	3
Crepis setosa Haller fil.	.	.	.	.	.	.	.	+	.	+	+	.	3
Allium tenuiflorum Ten.	+	+	+	.	.	.	.	.	.	.	.	.	3
Bromus sterilis L.	.	.	+	.	.	.	+	.	.	.	+	.	3
Accidental species	2	7	6	2	1	8	9	4	5	4	5	-	

are autochthonous since they are found on suitable substrata for this species, which is known to be calcifuge. Indeed, these are soils classifiable as “suoli bruni mediterranei”, with a neutral pH and very limited traces of calcium carbonate (Vita & Leone, 1980; Scarascia Mugnozza & Schirone, 1983). The potential distribution area of the Apulian cork oak woods is shown in Fig. 5.

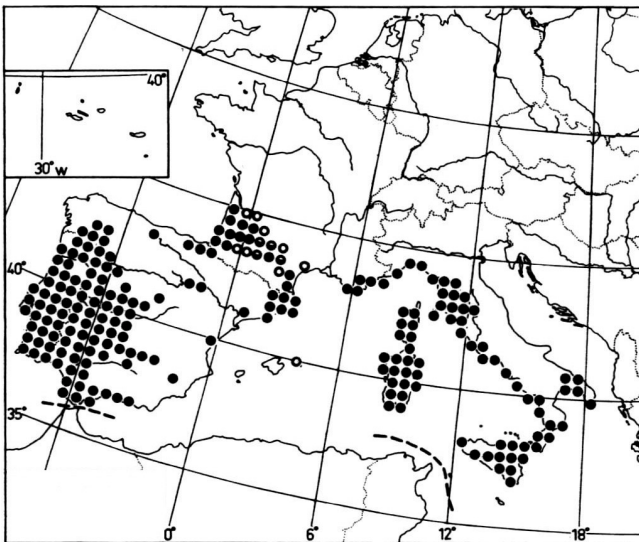


Fig. 4 - Distribution area of *Quercus suber* L. in Europe (from Jalas & Suominen, 1976)

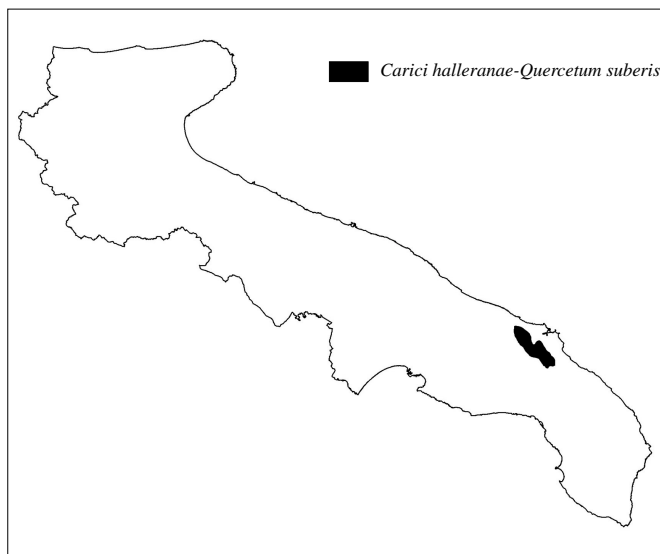


Fig. 5 - Potential distribution area of the Apulian cork oak woods

CARICI HALLERANAE-QUERCETUM SUBERIS ass. nova
(type rel. n. 6 of Tab. 2)

The Apulian cork oak woods are attributed to this subhumid, Mesomediterranean association that grows on neutral or subacidophilous soils. These are mainly high forests of limited extent, although they are rather well conserved, they are found in plain areas with sandy soils originated from a bedrock of limestone and calcareous sandstones and are periodically subjected to fires.

The characteristic and differential species of the association, in contrast to those described for similar ecological conditions in Sicily (*Stipo bromoidis-Quercetum suberis* and *Carici serrulatae-Quercetum suberis*) are: *Brachypodium sylvaticum*, *Myrtus communis*, *Carex hallerana*, *Arbutus unedo*, *Iris collina*, *Erica arborea* and *Viburnum tinus*.

The association to which the Apulian cork oak woods are closest is *Carici serrulatae-Quercetum suberis* Cirino, Ferrauto & Longhitano 1998, described for the vulcanites of the areas of “Cava Riscione” and “Bosco Pisano” in the Ibleo territory, from which, however, the Apulia vegetation is differentiated by the presence of numerous floristic elements that constitute the characteristic and differential group of entities of the new association.

The kermes oak woods

The systematic position of *Quercus calliprinos* Webb is still in doubt despite numerous studies carried out in the past; some authors include it in the cycle of *Quercus coccifera* L. (Schwarz, 1936-1937; Rikli 1943-1948; Corti, 1967; Tutin *et al.*, 1993), while for others it is a subspecies, or variety or race of the latter (Boissier, 1879; Baldacci, 1894; Den Halacsy, 1904; Fiori, 1923-1929, etc.). Still others recognise it as an autonomous species (Poech, 1842; De Candolle, 1864; Oersted, 1871-72; Nyman 1878-82; Camus, 1936-1938; Zohary, 1961). The experts who have studied the Apulian kermes oak are in agreement that it is actually *Quercus calliprinos* Webb (Corti, 1954; Gentile, 1962; Chiesura Lorenzoni *et al.*, 1971; 1974).

According to “Flora Europaea”, *Quercus coccifera* s.l. has a circum-Mediterranean distribution that extends from western Europe to Asia Minor (Fig. 6). In particular, it is possible to recognise a western distribution area that can be attributed to *Q. coccifera* L. s.s. that includes southern Portugal, the central-

Tab. 2 - *Carici halleranae-Quercetum suberis* ass. nova

Rel. n.	1	2	3	4	5	6*	P
Altitude (m)	90	55	55	90	50	50	r
Exposure	-	-	-	-	-	-	e
Slope (°)	-	-	-	-	-	-	s.
High of the tree layer (m)	15	10	10	12	15	15	
Coverage (%)	100	100	100	100	100	100	
Area (m ²)	250	250	250	200	250	250	
Charact. and diff. species of the association							
Brachypodium sylvaticum (Hudson) Beauv.	2.2	1.2	1.2	1.2	2.2	2.2	6
Myrtus communis L.	1.2	2.3	2.3	3.3	3.3	3.4	6
Carex hallerana Asso	.	2.2	1.2	.	2.3	2.3	4
Arbutus unedo L.	2.3	2.2	2.2	+2	.	.	4
Iris collina Terr.	.	+2	(+)	.	.	.	2
Stipa bromoides (L.) Doerfl.	.	.	.	.	+2	+	2
Erica arborea L.	2.2	1.2	.	.	.	.	2
Viburnum tinus L.	1.2	.	.	1.2	.	.	2
Charact. and diff. species of the <i>Fraxino orni-Quercion ilicis</i> all.							
Calicotome infesta (Presl.) Guss.	2.2	1.2	1.2	.	.	.	3
Cyclamen hederifolium Aiton	.	.	.	.	+2	+	2
Quercus virgiliana (Ten.) Ten.	.	.	.	.	+2	1.2	2
Tamus communis L.	.	.	.	.	+	+	2
Charact. and diff. species of the <i>Quercetalia ilicis</i> order and the <i>Quercetea ilicis</i> class							
Quercus suber L.	4.4	4.5	4.5	5.5	4.4	4.4	6
Phillyrea media L.	3.4	3.4	3.4	3.4	2.2	2.2	6
Asparagus acutifolius L.	1.2	2.2	1.2	1.2	1.2	1.2	6
Pistacia lentiscus L.	2.2	1.2	3.3	2.3	+2	1.2	6
Smilax aspera L.	1.2	1.2	2.2	+2	1.2	2.3	6
Rubia peregrina L. var. longifolia Poir.	2.3	2.2	2.2	2.3	1.2	.	5
Ruscus aculeatus L.	.	+	1.2	1.2	2.2	2.3	5
Rosa sempervirens L.	.	1.2	1.2	2.2	1.2	1.2	5
Lonicera implexa Aiton	1.2	1.2	1.2	+	.	.	4
Carex distachya Desf.	2.2	.	.	1.2	+2	1.2	4
Melica arrecta O. Kuntze	.	1.1	+2	+	1.2	.	4
Quercus ilex L.	.	.	.	.	3.3	3.5	2
Daphne gnidium L.	+	+	.	.	.	.	2
Rhamnus alaternus L.	.	.	+2	.	.	.	1
Olea europaea L. var. sylvestris Brot.	.	.	.	+2	.	.	1
Phillyrea angustifolia L.	.	.	.	+2	.	.	1
Olea europaea L.	.	.	.	.	.	+	1
Pistacia terebinthus L.	.	.	+	.	.	.	1
Other species							
Carex flacca Schreber	+2	1.2	+2	.	+2	+	5
Osyris alba L.	+2	.	.	.	1.2	1.2	3
Pulicaria odora (L.) Rehb.	.	1.2	+	+2	.	.	3
Rubus ulmifolius Schott	.	.	+2	+	1.2	.	3
Prunus spinosa L.	.	+	.	.	+2	+	3
Crataegus monogyna Jacq.	.	.	.	.	1.2	1.1	2
Pyrus amygdaliformis Vill.	.	.	1.2	+2	.	.	2
Allium subhirsutum L.	.	.	.	.	1.1	1.1	2
Oenanthe pimpinelloides L.	.	.	+	.	.	+	2
Clinopodium vulgare L.	.	+	.	.	+	.	2
Accidental species	1	1	-	-	-	4	

southern Iberian peninsula, southern France, Sardinia, Morocco, Tunisia and Algeria, and an eastern distribution area specifically of *Q. calliprinos* that extends from south-eastern Italy and southern Istria, across Dalmatia to the Dalmatian Islands, Albania, Greece, Bulgaria, the Turkey coast and the Black Sea, and reaches as far as Syria and Palestine (Sabato, 1972). For Sardinia, however, it is thought that it must be

referred to as *Q. calliprinos* (Mossa, 1990).

As far as Apulia in particular is concerned, the distribution area of *Q. calliprinos* is divided into two sub-areas, one of which corresponds to the Bari Murge area and the other to Salento (Sabato, 1972; Bianco *et al.*, 1981-1982).

On the basis of relevées from several localities of Salento and of the Brindisi Murge area, the Apulian

vegetation of *Quercus calliprinos* can be divided into two main structural types, one of which is of low shrubbery and the other of a forest type. These shrubberies are found either at the edges of the high forest of kermes oak and holm oak, on more or less rocky substratum made up of large calcareous pebbles (Lama di Macchialonga, Maglie, “Bosco di Fraganite”, Santeramo in Colle, “Bosco la Parata”), or as recovery vegetation on terra rossa and on rather deep soils (Conversano); these phytocoenoses are clearly referable to the *Arbuto unedi-Quercetum calliprini* association. The mature woods, sometimes high forests pure or mixed with holm oak (Maglie, Ruffano, Madonna della Serra, Supersano), are instead referable to the new *Hedero heliis-Quercetum calliprini* association.

ARBUTO-QUERCETUM CALLIPRINI Brullo, Minissale, Signorello & Spampinato 1987 (type rel. n. 5 of Tab. 3 in Brullo, Minissale, Signorello & Spampinato 1987) (Rel. n. 1-7 of Tab. 3)

This association, described for Salento, represents the dense and intricate shrubberies of evergreen sclerophylls dominated by the kermes oak with numerous species of the *Pistacio-Rhamnetalia* order and of the *Oleo-Ceratonion* alliance, among which there are: *Myrtus communis*, *Pistacia lentiscus*, *Prasium majus* and *Olea europaea* var. *sylvestris*. The characteristic species are: *Quercus calliprinos* and *Arbutus unedo*.

The association is referred by the authors to the *Pistacio-Rhamnetalia* order and to the *Oleo-Ceratonion*

alliance; furthermore, according to the authors, it would represent the climax vegetation of south-eastern Salento. On the basis of the observations and relevés taken as part of the present study, in the territory of Salento the association actually corresponds to a shrubbery stage that is the prelude to the true kermes oak wood, climatophilous for the inland areas of Salento and referable to the new *Hedero heliis-Quercetum calliprini* association that is presented below.

HEDERO HELICIS-QUERCETUM CALLIPRINI ass. nova

(type rel. n. 9 of Tab. 3)

This association represents the climatophilous forest of the inland areas of the Salento peninsula (Fig. 7) relative to the subhumid, Thermomediterranean bioclimatic belt, and it is well differentiated structurally and floristically from the above-mentioned association, as detailed in Tab. 3.

The characteristic and differential species are (with respect to *Arbuto-Quercetum calliprini*): *Quercus ilex*, *Ruscus aculeatus*, *Stipa bromoides*, *Hedera helix*, *Brachypodium sylvaticum*, *Allium subhirsutum*, *Viburnum tinus* and *Iris collina*.

Among the associations described, the most similar is *Phillyreo latifoliae-Quercetum calliprini* Knapp 1965 em. Barb. et Quéz. 1976, of the sclerophyllous woods and shrubberies dominated by *Quercus calliprinos* of the Island of Cefalonia (De Bolós *et al.*, 1996). In particular, the closest affinity is seen with the *rubio-arbutetosum andrachnes* (Knapp) Barb. & Quéz. 1976

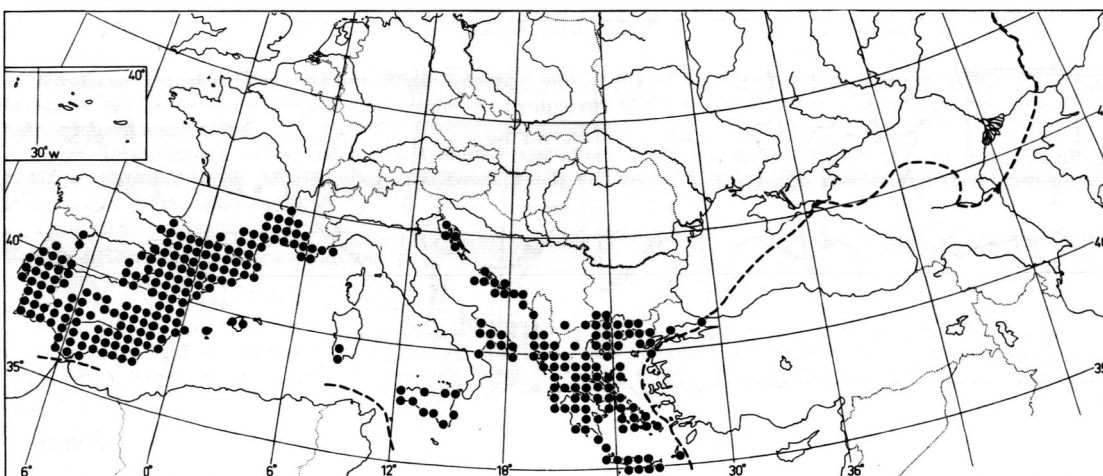


Fig. 6 - Distribution area of *Quercus coccifera* L. s.l. in Europe (from Jalas & Suominen, 1976)

Tab. 3 - *Arbuto-Quercetum calliprini* Brullo, Minissale, Signorello, Spampinato 1987 (rel. 1-7)
Hedero helcis-Quercetum calliprini ass. nova (rel. 8-14)

Rel. n.	1	2	3	4	5	6	7	8	9*	10	11	12	13	14	P
Altitude (m)	-	-	-	-	-	-	-	75	85	130	120	135	390	5	r
Exposure	-	-	-	-	-	-	-	-	-	E	W-NW	E	-	-	e
Slope (°)	-	-	-	-	-	-	-	-	-	20	20	5	-	-	s.
High of the tree layer (m)	-	-	-	-	-	-	-	10	12	8	1,5	4	5	6	
Coverage (%)	100	100	100	100	100	100	100	100	100	100	90	100	100	100	
Area (m ²)	50	100	100	100	80	100	200	200	200	200	50	200	200	100	
Charact. and diff. species of the <i>Arbuto-Quercetum calliprini</i> ass.															
<i>Quercus calliprinos</i> Webb	4	4	3	3	3	4	4	4,4	4,5	4,5	4,4	5,5	5,5	3,3	14
<i>Arbutus unedo</i> L.	3	2	2	3	3	3	1	+	.	1,2	.	.	.	.	9
Charact. and diff. species of the <i>Hedero helcis-Quercetum calliprini</i> ass.															
<i>Quercus ilex</i> L.	.	.	.	.	.	.	.	3,4	2,3	2,3	+	.	.	1,2	5
<i>Ruscus aculeatus</i> L.	.	.	.	.	.	.	.	2,3	2,3	2,3	.	.	.	3,3	4
<i>Stipa bromoides</i> (L.) Doerfl.	.	.	.	.	.	.	.	.	.	+2	+	1,2	+2	.	4
<i>Hedera helix</i> L.	.	.	.	.	.	.	.	2,2	2,3	+2	.	.	1,2	.	4
<i>Brachypodium sylvaticum</i> (Hudson) Beauv.	.	.	.	.	.	.	+	+	1,2	.	.	.	.	.	3
<i>Allium subhirsutum</i> L.	.	.	.	.	.	.	.	.	.	1,1	+	1,1	.	.	3
<i>Viburnum tinus</i> L.	.	.	.	.	.	.	.	2,3	1,2	.	.	.	.	.	2
<i>Iris collina</i> Terr.	.	.	.	.	.	.	.	.	+	.	.	.	+2	.	2
Charact. and diff. species of the <i>Oleo-Ceratonion</i> all. and the <i>Pistacio-Rhamnetalia</i> order															
<i>Pistacia lentiscus</i> L.	2	2	1	1	2	2	2	1,2	2,2	1,2	3,3	2,3	.	3,3	13
<i>Rhamnus alaternus</i> L.	1	1	1	1	+	1	1	.	.	2,2	4,4	2,3	.	3,3	11
<i>Lonicera implexa</i> Aiton	+	1	+	+	1	1	.	+	.	.	1,2	+2	.	1,2	10
<i>Osyris alba</i> L.	+	2	1	1	1	2	+	+	+	1,2	.	.	.	.	10
<i>Myrtus communis</i> L.	2	2	3	2	2	2	+	.	.	1,2	.	1,2	.	.	9
<i>Prasium majus</i> L.	+	+	+	+	1	+	.	.	.	+	1,2	.	.	+2	9
<i>Daphne gnidium</i> L.	1	1	+	1	1	1	+	.	.	.	+	.	.	.	8
<i>Phillyrea angustifolia</i> L.	.	1	2	2	2	2	.	.	.	.	.	2,2	.	2,3	7
<i>Olea europaea</i> L. var. <i>sylvestris</i> Brot.	.	.	.	+	+	.	1	.	.	+	+	+	.	.	6
<i>Calicotome infesta</i> (Presl.) Guss.	+	.	.	.	.	.	.	.	.	.	1,2	.	.	1,2	3
<i>Juniperus oxycedrus</i> L. ssp. <i>macrocarpa</i> (S. et S.) Ball	+	1	.	.	.	.	.	.	.	.	.	.	.	+	3
<i>Pistacia terebinthus</i> L.	.	.	.	.	.	.	.	.	.	1,2	.	+2	.	.	2
<i>Euphorbia characias</i> L.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	1
Charact. and diff. species of the <i>Fraxino-orni-Quercion</i> all., the <i>Quercetalia ilicis</i> order and the <i>Quercetea ilicis</i> class															
<i>Rubia peregrina</i> L. var. <i>longifolia</i> Poiret	2	1	1	2	1	2	2	1,1	1,2	1,2	+	1,2	2,2	2,2	14
<i>Asparagus acutifolius</i> L.	1	+	.	+	+	+	1	1,2	1,2	1,1	1,2	1,1	1,2	.	12
<i>Smilax aspera</i> L.	1	1	+	1	2	1	+	.	+2	3,3	1,2	1,2	.	3,3	12
<i>Phillyrea latifolia</i> L.	1	2	3	2	2	1	+	.	.	.	.	.	.	.	7
<i>Phillyrea media</i> L.	.	.	.	.	.	.	.	2,2	+2	2,2	2,3	1,2	.	+2	6
<i>Carex distachya</i> Desf.	.	.	.	+	+	.	+	1,2	2,2	.	1,2	.	.	.	6
<i>Carex hallerana</i> Asso	.	.	.	.	.	.	.	.	+2	+2	.	1,2	+	.	4
<i>Cyclamen hederifolium</i> Aiton	.	.	.	.	+	+	+	.	.	.	.	.	1,2	.	4
<i>Teucrium flavum</i> L. ssp. <i>flavum</i>	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1
<i>Lonicera etrusca</i> Santi	.	.	.	.	.	.	.	.	.	.	.	.	1,2	.	1
<i>Laurus nobilis</i> L.	.	.	.	.	.	.	.	.	1,1	.	.	.	.	.	1
<i>Quercus trojana</i> Webb	.	.	.	.	.	.	.	.	.	.	.	.	1,1	.	1
Other species															
<i>Brachypodium ramosum</i> (L.) R. et S.	1	1	+	2	+	2	1	.	.	.	.	.	.	.	7
<i>Rubus ulmifolius</i> Schott	1	1	.	.	1	1	1	.	+2	.	.	.	.	.	6
<i>Dorycnium hirsutum</i> (L.) Ser.	.	+	1	+	+	1	.	.	.	.	.	.	.	.	5
<i>Cistus creticus</i> L.	1	1	+	.	.	.	+	.	.	.	.	.	.	.	4
<i>Silene italica</i> (L.) Pers.	+	.	.	+	+	+	.	.	.	.	.	.	.	.	4
<i>Erica manipuliflora</i> Salisb.	1	.	.	+	.	.	.	.	.	.	.	.	.	.	2
<i>Hypericum perforatum</i> L.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	2
<i>Daucus carota</i> L.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	2
Accidental species	1	-	-	-	1	-	1	1	2	-	3	-	11	2	

subassociation, present in the north-eastern sectors of the island and that represents the transition towards the woods of *Quercus ilex* with deciduous species. With respect to this last, the Apulian woods of *Q. calliprinos* are differentiated by the absence of *Arbutus andrachne*, a species not present in the Italian territory.

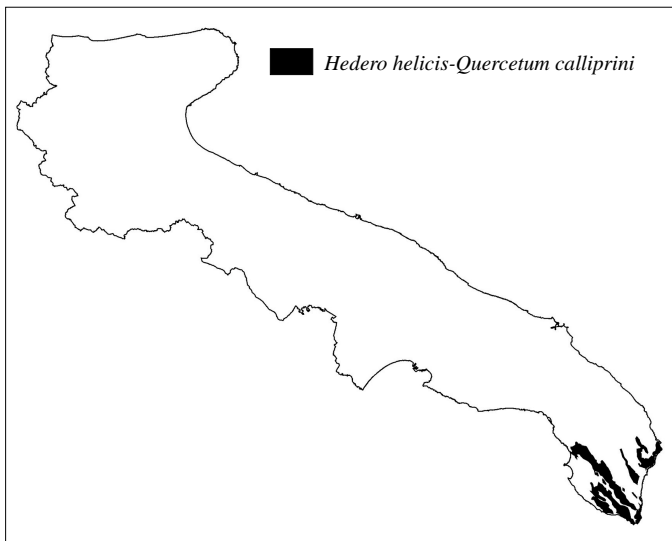


Fig. 7 - Potential distribution area of the *Quercus calliprinos* Webb communities in Apulian

The holm oak woods

In Apulia, the holm oak woods are widely distributed throughout the regional territory, although well-conserved nuclei are limited to only a few places. These woods are used for timber and for pasturing, and therefore in many cases they have the appearance of the typical Mediterranean shrubbery. The largest portions of holm oak woods are concentrated on the Gargano promontory near San Marco in Lamis, Sannicandro and Mount Coppa Ferrata, in the “Bosco delle Pianelle” near Martina Franca, in the “Gravina di Laterza” and in other “gravine” of the Taranto area (Leucaspede, Alezza, etc.), in some areas of Salento (“Bosco di Rauccio”, Castro Marina, Frigole, etc.), and in some coastal holm oak woods on sand in the Brindisi and Salento areas.

From the potentiality point of view, the holm oak woods would occupy a much greater area than at present

(Fig. 8) given the abundance of calcareous substrata that make up the geological structure of the entire region and its climatic characteristics. On the basis of previous phytosociological studies, the holm oak woods of Gargano have been referred to the associations: *Orno-Quercetum ilicis* (Horvatić 1939) Horvatić 1958 and *Ostryo-Quercetum ilicis* (Horvatić 1958) Trinajstić (1965) 1974 (Biondi, 1985), while those of Salento, the subject of phytosociological studies carried out over the course of nearly 20 years from the early 1970s to the end of the 1980s, have been attributed to the *Quercetum ilicis galloprovinciale* Br.-Bl. (1915) 1936 association (Lorenzoni, 1967a, b; 1978; Lorenzoni & Ghirelli, 1988; Curti *et al.*, 1974; Caniglia *et al.*, 1984) or more generally to a *Quercetum ilicis* s.l., as in the case of “Bosco di Rauccio” (Lorenzoni *et al.*, 1984). The holm oak woods that grow along the shaded slopes and at the bottom of the valleys in conditions of good edaphic humidity have been, moreover, attributed to the *Pistacio-Quercetum ilicis* Brullo & Marcenò 1984 association (Bianco *et al.*, 1998). On the basis of a recent revision of the Italian holm oak woods (Biondi *et al.*, 2003) and of the study presented here, the Apulian thermophilous holm oak woods should be attributed mainly to the *Cyclamino hederifolii-Quercetum ilicis* association, while the mesophilous holm oak woods, which in Apulia are found mainly in some sectors of the northern slopes of Gargano (Biondi, 1985) and in “Bosco delle Pianelle”, are referred to the *Cephalanthero longifoliae-Quercetum ilicis* and *Festuco exaltatae-Quercetum ilicis* associations.

CYCLAMINO HEDERIFOLII-QUERCETUM ILICIS

Biondi, Casavecchia & Gigante 2003

cyclaminetosum hederifolii Biondi, Casavecchia & Gigante 2003 (rels. n. 1-11 of Tab. 4)

carpinetosum orientalis Biondi, Casavecchia & Gigante 2003 (rels. n. 12-22 of Tab. 4)

myrtetosum communis subass. nova (rels. n. 23-27 of Tab. 4; type rel. n. 26 of Tab. 4)

On the Italian peninsula, this association substitutes for the Balcan *Orno-Quercetum ilicis* association. Of this, various subassociations have been individuated as a function of the ecological conditions in which these woods grow.

The subassociation *cyclaminetosum hederifolii* can be found in “Bosco delle Pianelle”, near Martina Franca (Taranto) and in other areas of central Apulia (Murge,

Tavoliere, “Gravina di Laterza” and “Gravina di Leucaspide”), in the subhumid, Mesomediterranean bioclimatic belt.

Cyclamino hederifolii-Quercetum ilicis Biondi, Casavecchia & Gigante 2003 *carpinetosum orientalis*

The holm oak woods of Gargano and a large part of those found along the slopes of the large valley system of “Gravina di Laterza” can be referred to the mesophilous Supramediterranean *carpinetosum orientalis* subassociation, differentiated by *Carpinus orientalis*, *Pistacia terebinthus*, etc.

Cyclamino hederifolii-Quercetum ilicis Biondi, Casavecchia & Gigante 2003 *myrtetosum communis*

The holm oak woods of Salento, mainly diffuse in the coastal and sub-coastal areas, should be referred to the new subhumid, Thermomediterranean *myrtetosum communis* subassociation; they have a more oceanic character due to the more humid climatic conditions. The differential species are: *Myrtus communis*, *Laurus nobilis*, *Quercus calliprinos* and *Olea europaea* var. *sylvestris*.

CEPHALANTHERO LONGIFOLIAE-QUERCETUM ILICIS Biondi & Venanzoni ex Biondi, Gigante, Pignattelli & Venanzoni 2002

lauretosum nobilis Biondi, Casavecchia & Gigante 2003
This association represents the western Adriatic substitute of the eastern *Ostryo-Quercetum ilicis* (Horvatic 1958) Trinajstic (1966) 1974.

The calcicole mesophilous holm oak woods, with laurel and abundant hop hornbeam, can be referred to the Mesomediterranean *lauretosum nobilis* subassociation.

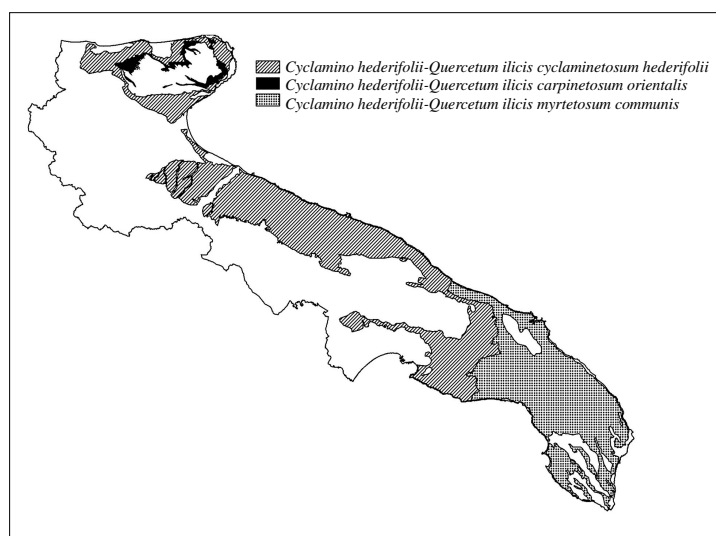


Fig. 8 - Potential distribution area of the Apulian thermophilous holm oak woods

They are found on the north-eastern aspects of the Gargano promontory at altitudes between 700 and 800 m, near Mount Coppa Ferrata, “Punta dell’Acero” and “Punta la Rampa”, and were previously described as *Ostryo-Quercetum ilicis* (Biondi, 1985).

FESTUCO EXALTATAE-QUERCETUM ILICIS Biondi, Casavecchia & Gigante 2003

festucetosum exaltatae Biondi, Casavecchia & Gigante 2003 (rels. n. 1-3 of Tab. 5)

carpinetosum orientalis subass. nova (type rel. n. 5 of Tab. 5)

A Mesomediterranean association with a meso-hygrophilous character, more thermophilous than the last, with an exclusively southern distribution. The holm oak woods of “Bosco delle Pianelle” and the “gravine” of the Ionic arc (Laterza, Leucaspide, Alezza and Triglio) are referred to this association, and are found in the small valleys or at the bottoms of the slopes that have an accumulation of soil and good edaphic and atmospheric humidity. It is the typical wood of the ravines of southern Italy.

Within this association, the new *carpinetosum orientalis* subassociation has been individuated, the structure of which is given by a dominant layer of holm oak and a dominated one of the oriental hornbeam. The differential species, besides *Carpinus orientalis*, are: *Scutellaria columnae* ssp. *columnae* and *Orobancha hederæ*. These phytocoenoses are the linkage between the evergreen sclerophyll and the deciduous woods referable to the *Quercetea ilicis* and *Querceto-Fagetea* classes, respectively.

The Trojan oak woods

Quercus trojana is an oak of eastern distribution, present in Italy, where it has the western limit of its distribution area, exclusively in the south-eastern Murge territories between the regions of Apulia and Basilicata (Fig. 9). For the Apulian territory, two associations can be recognised: *Euphorbio apii-Quercetum trojanae* Bianco, Brullo, Minissale, Signorello & Spampinato 1998 and *Teucro siculi-Quercetum trojanae* ass. nova, the potential distribution of which is shown in Fig. 10.

EUPHORBIO APII-QUERCETUM TROJANAE Bianco, Brullo, Minissale, Signorello & Spampinato 1998

Tab. 5 - *Festuco exaltatae-Quercetum ilicis* Biondi, Casavecchia & Gigante 2003
festucetosum exaltatae Biondi, Casavecchia & Gigante 2003 (rel. 1-3)
carpinetosum orientalis subass. nova (rel. 4-13)

Rel. n.	1	2	3	4	5*	6	7	8	9	10	11	12	13	P
Altitude (m)	410	220	100	400	435	420	425	430	402	425	283	250	460	r
Exposure	ESE	W	WNW	-	WNW	ESE	WSW	ENE	NW	NW	NW	-	WSW	e
Slope (°)	15	20	40	-	20	12	22	18	22	35	30	-	22	s.
High of the tree layer (m)	10	10	15	12	15	15	10	15	15	8	8	10	10	
Coverage (%)	100	100	100	100	100	100	80	100	100	100	100	100	100	
Area (m ²)	200	200	200	400	300	200	200	300	300	300	150	400	200	
Charact. and diff. species of the association														
<i>Festuca exaltata</i> C. Presl	1.1	1.2	1.2	3.4	3.4	1.1	3.4	3.4	4.3	3.3	1.2	2.2	2.3	13
<i>Cyclamen hederifolium</i> Aiton	.	.	3.2	1.1	2.2	+	1.2	1.2	.	.	1.2	2.2	.	7
Diff. species of the <i>carpinetosum orientalis</i> subass.														
<i>Carpinus orientalis</i> Miller	.	.	.	5.5	3.2	4.3	4.2	5.4	4.4	4.4	5.5	2.2	1.2	10
<i>Scutellaria columnae</i> All. ssp. <i>columnae</i>	.	.	.	.	+	+	.	+	.	.	.	+2	.	4
<i>Orobanche hederæ</i> Duby	.	.	.	+	.	+	.	.	+2	.	.	+	.	4
Charact. and diff. species of the <i>Fraxino orn-Quercion ilicis</i> all.														
<i>Quercus ilex</i> L.	4.4	5.5	5.5	1.2	4.2	3.1	3.2	3.2	2.1	3.2	1.1	5.4	5.4	13
<i>Fraxinus ornus</i> L.	3.3	1.1	.	1.1	+	1.1	3.2	2.2	.	1.2	1.1	3.2	2.2	11
<i>Tamus communis</i> L.	1.1	.	.	+	.	1.1	+	.	+	.	.	.	.	5
<i>Hippocrepis emerus</i> (L.) Lassen ssp. <i>emeroides</i> (Boiss. et Spruner) Lassen	.	.	+2	.	.	.	.	.	.	.	+	+	1.2	4
<i>Ostrya carpinifolia</i> Scop.	.	.	.	3.2	2.1	+	.	.	.	.	.	.	.	3
<i>Quercus virgiliana</i> (Ten.) Ten.	.	2.2	.	.	+	+	.	.	.	.	.	.	.	3
<i>Quercus dalechampii</i> Ten.	.	+	.	.	.	.	.	.	.	.	.	+	.	2
Charact. species of the <i>Quercetalia ilicis</i> order and the <i>Quercetea ilicis</i> class														
<i>Ruscus aculeatus</i> L.	1.2	+	.	3.4	.	1.2	3.3	2.2	1.1	2.2	3.2	2.2	3.3	11
<i>Rubia peregrina</i> L. var. <i>longifolia</i> Poirlet	+	1.2	3.2	+	1.2	+2	1.2	+	.	.	+	+2	1.2	11
<i>Asplenium onopteris</i> L.	1.1	+	.	2.2	.	+	+2	1.2	1.1	+	.	.	1.2	9
<i>Asparagus acutifolius</i> L.	.	+	1.2	1.2	+	+	+	.	+	.	+	1.2	.	9
<i>Arbutus unedo</i> L.	2.2	+	.	+	.	1.2	3.2	.	.	+	+	.	1.2	8
<i>Carex hallerana</i> Asso	.	2.2	1.2	+2	.	.	1.2	.	.	.	+	.	1.1	6
<i>Smilax aspera</i> L.	.	2.2	3.3	.	.	.	.	.	.	1.2	1.2	3.3	1.2	6
<i>Viburnum tinus</i> L.	4.4	2.2	.	.	.	.	.	2.1	3.2	1.2	3.3	.	.	6
<i>Phillyrea latifolia</i> L.	2.2	.	.	.	.	+	1.2	1.2	.	.	.	.	1.2	6
<i>Rosa sempervirens</i> L.	.	1.2	1.2	+	.	.	.	.	.	.	.	.	+	4
<i>Allium subhirsutum</i> L.	.	.	.	.	.	+2	+2	1.2	.	.	.	.	+2	4
<i>Phillyrea media</i> L.	.	2.3	.	1.1	.	.	.	.	.	.	.	1.2	.	3
<i>Pistacia lentiscus</i> L.	.	2.3	2.2	.	.	.	.	.	.	.	.	+2	.	3
<i>Carex distachya</i> Desf.	.	.	1.2	.	.	+	.	.	.	.	.	.	.	2
<i>Melica arrecta</i> O. Kuntze	.	.	.	.	.	.	1.2	.	.	.	.	.	+	2
<i>Limodorum abortivum</i> (L.) Swartz	.	.	.	.	+	+	.	.	.	.	.	.	.	2
<i>Pistacia terebinthus</i> L.	.	+	.	.	.	.	.	.	.	.	+	.	.	2
<i>Paliurus spina christi</i> Miller	.	.	1.1	.	.	.	.	.	.	.	.	.	.	1
<i>Rhamnus alaternus</i> L.	.	+2	.	.	.	.	.	.	.	.	.	.	.	1
<i>Clematis flammula</i> L.	.	+	.	.	.	.	.	.	.	.	.	.	.	1
<i>Quercus trojana</i> Webb	.	.	.	.	.	+	.	.	.	.	.	.	.	1
<i>Lonicera etrusca</i> Santi	.	.	.	.	.	.	.	.	.	.	+	.	.	1
<i>Erica arborea</i> L.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	1
<i>Pinus halepensis</i> Mill. pl.	.	+	.	.	.	.	.	.	.	.	.	.	.	1
Other species														
<i>Hedera helix</i> L.	2.2	.	2.2	3.5	3.3	1.2	1.2	1.2	3.2	.	3.2	+2	2.2	11
<i>Viola alba</i> Besser ssp. <i>dehnhardtii</i> (Ten.) W. Becker	.	1.2	2.2	.	+	1.2	.	+	+	.	+2	2.2	1.1	9
<i>Brachypodium sylvaticum</i> (Hudson) Beauv.	.	+2	3.2	1.2	+2	+	+2	.	.	.	1.2	2.2	1.1	9
<i>Crataegus monogyna</i> Jacq.	+	+	1.2	1.1	.	.	1.1	+	+	.	+	.	1.1	9
<i>Rubus ulmifolius</i> Schott	1.2	+	1.2	.	.	.	.	+	.	.	1.2	.	+	6
<i>Ceterach officinarum</i> DC.	.	.	.	.	+2	+	+	.	.	.	.	+2	+	5
<i>Silene italica</i> (L.) Pers.	.	.	.	.	+	+	.	.	.	.	+	.	+	4
<i>Asplenium trichomanes</i> L.	.	.	.	.	+2	.	+	.	.	.	.	+	+	4
<i>Urginea maritima</i> (L.) Baker	.	.	.	.	.	+	+	.	.	.	.	.	1.1	3
<i>Geranium purpureum</i> Vill.	.	.	+2	.	+	+	.	.	.	.	.	.	.	3
<i>Euonymus europaeus</i> L.	.	.	.	.	+	+	.	+	.	.	.	.	.	3
<i>Polypodium vulgare</i> L.	.	.	.	.	.	+	.	+	.	.	.	+2	.	3
<i>Umbilicus horizontalis</i> (Guss.) DC.	.	.	.	+	+	+	.	.	.	.	.	.	.	3
Accidental species														
	-	7	3	1	5	5	-	4	-	-	8	4	-	

quercetosum trojanae subass. nova (type rel. n. 11 of Tab. 1 in Bianco *et al.*, 1998)

poetosum sylvicolae Bianco, Brullo, Minissale, Signorello & Spampinato 1998

The dendrogram in Fig. 11, obtained from a matrix

made up of unpublished relevées taken in the course of the present study to which have been added those published in Bianco *et al.* (1998), shows two main clusters corresponding to the *Quercus trojana* woods of Laterza Murge and those of the rest of the south-

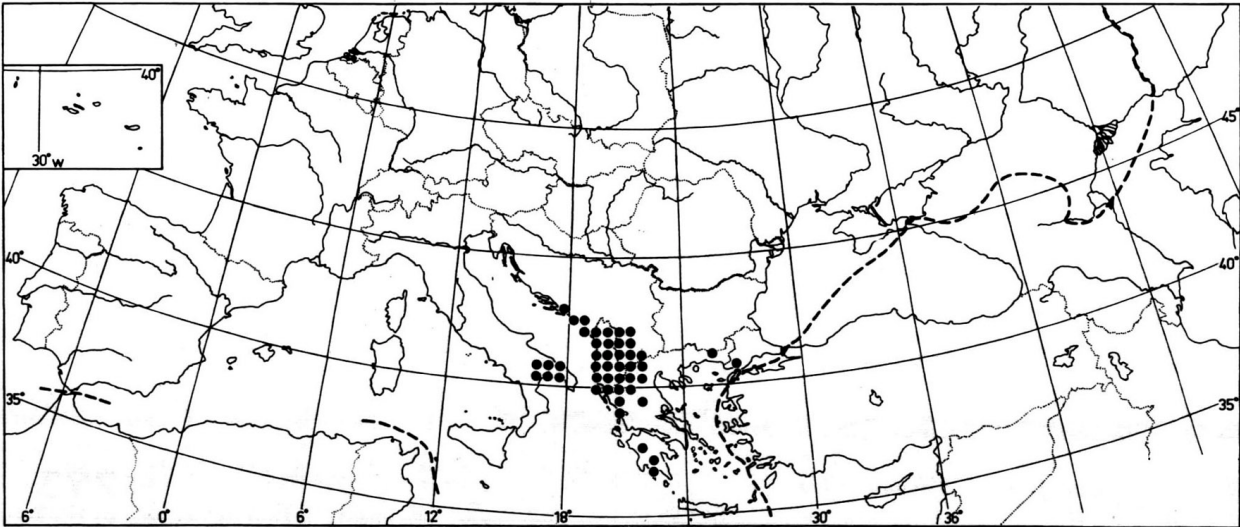


Fig. 9 - Distribution area of *Quercus trojana* Webb (from Jalas & Suominen, 1976)

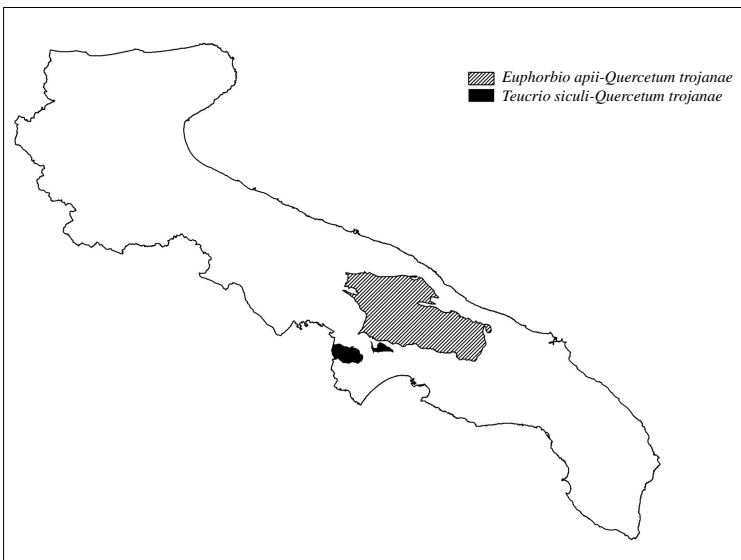


Fig. 10 - Potential distribution area of *Quercus trojana* woods in Apulia

eastern Murge. This last cluster includes the relevées attributed to the thermophilous Mesomediterranean *Euphorbio apii-Quercetum trojanae* association, characterised by *Euphorbia apios*, *Potentilla detommassii* and *Arum apulum*. Furthermore, within the same association, the more mesophilous *poetosum sylvicolae* subassociation has been described. In agreement with the codes, it is necessary to propose the typicum subassociation *quercetosum trojanae* subass. nova (holotype: rel. 11 of Tab. 1 in Bianco *et al.*, 1998). The association, included by the authors in the *Quercion ilicis* alliance, should be referred to the recently described central European Mediterranean alliance *Fraxino orni-Quercion ilicis* (Biondi *et al.*, 2003).

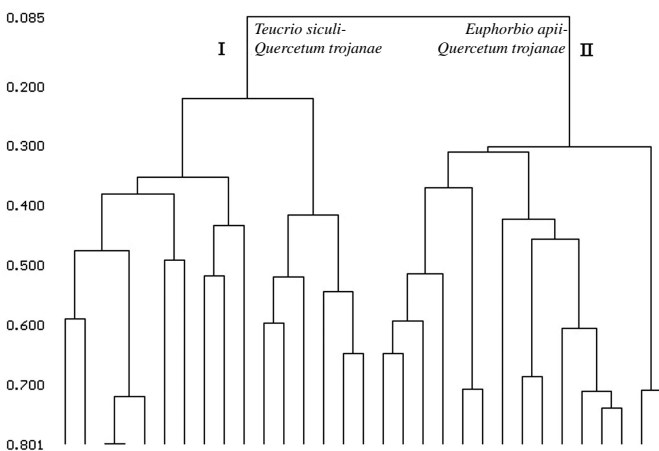


Fig. 11 - Dendrogram of the two Apulian associations of *Quercus trojana*

TEUCRIO SICULI-QUERCETUM TROJANAE ass. nova
(type rel. n. 9 of Tab. 6)

The neutro-subacidophilous mesoxerophilous woods, pure or mixed with *Quercus trojana* and *Quercus virgiliana* and with a large presence of *Carpinus orientalis*, can be referred to this new association. These can be found on the summit areas of the “gravine” at altitudes between 300 and 400 m and on the terraces of the Matera and Laterza Murge at altitudes up to 500 m, in the upper-dry and lower-subhumid, lower-Mesomediterranean bioclimatic belts. The soils on which they grow are of the “terre rosse mediterranee” type.

The characteristic species of the new association are considered to be: *Cyclamen hederifolium*, *Iris*

Tab. 6 - *Teucrio siculi-Quercetum trojanae* ass. nova
Festuca exaltata variant (ril. 1-8)

Rel. n.	1	2	3	4	5	6	7	8	9*	10	11	12	13	P
Altitude (m)	324	330	320	310	310	340	350	320	360	350	340	332	350	r
Exposure	WSW	WSW	NNE	NNW	NW	-	NE	-	NE	-	WSW	NE	W	e
Slope (°)	15	-	45	25	30	-	5	-	-	-	-	-	10	s.
High of the tree layer (m)	8-10	10-12	6	10	10-12	6	8	6	8	8	8-10	8	6-8	
Coverage (%)	100	80	100	100	100	100	80	100	70	85	90	80	90	
Area (m ²)	400	100	200	100	500	150	100	150	150	150	400	300	200	
Charact. and diff. species of the association														
<i>Quercus trojana</i> Webb	4.4	5.5	4.4	5.4	4.4	5.3	5.5	3.2	4.3	5.5	4.5	5.5	5.5	13
<i>Carpinus orientalis</i> Miller	3.3	2.2	4.5	3.3	4.5	2.2	2.2	2.2	3.3	1.2	3.4	1.2	1.2	13
<i>Cyclamen hederifolium</i> Aiton	.	+2	.	+2	.	+1.2	1.2	.	1.2	.	.	+2	1.1	8
<i>Teucrium siculum</i> Rafin.	+	1.2	.	.	.	.	+2	.	+2	+	1.2	1.2	.	7
<i>Iris collina</i> Terr.	+	.	.	.	.	1.2	1.2	.	+2	+2	+	.	+	7
<i>Festuca exaltata</i> variant														
<i>Festuca exaltata</i> C. Presl.	2.2	+2	3.2	2.2	3.4	1.2	1.2	+	.	.	.	.	.	8
<i>Acer monspessulanum</i> L.	+	+	1.2	2.2	1.2	.	.	2.2	.	.	.	.	.	6
Charact. species of the <i>Carpinion orientalis</i> all. and the <i>Lauro nobilis-Quercenion pubescens</i> suball.														
<i>Rubia peregrina</i> L. var. <i>longifolia</i> Poirlet	1.2	1.2	+2	.	+2.3	2.2	1.2	+	+2	+2	2.2	3.2	1.2	13
<i>Ruscus aculeatus</i> L.	1.2	1.2	2.3	3.3	2.3	3.2	2.2	1.2	2.2	1.2	2.3	1.2	3.3	13
<i>Asparagus acutifolius</i> L.	+2	.	1.2	1.2	1.2	1.2	+2	+	1.2	1.2	1.2	2.2	1.1	12
<i>Fraxinus ornus</i> L.	+2	+	1.2	.	1.2	1.1	1.1	1.2	.	1.2	+	.	+	10
<i>Rosa sempervirens</i> L.	+2	2.2	.	.	1.2	+	.	1.2	+	1.2	2.3	1.2	1.2	10
<i>Quercus virgiliana</i> (Ten.) Ten.	2.2	1.1	1.2	+	.	.	.	.	.	1.1	1.2	2.2	.	7
<i>Phillyrea latifolia</i> L.	+	.	.	.	.	.	1.2	3.2	.	+2	.	+2	1.2	6
<i>Hippocrepis emerus</i> (L.) Lassen ssp. <i>emeroides</i> (Boiss. et Spruner) Lassen	.	1.2	.	1.2	1.2	.	2.2	.	.	.	.	.	.	4
<i>Smilax aspera</i> L.	.	.	.	.	.	.	+2	3.3	.	.	.	.	1.2	3
<i>Viburnum tinus</i> L.	.	.	.	.	+	.	.	.	.	.	.	.	.	1
Charact. species of the <i>Quercetalia pubescens-petraeae</i> order and the <i>Quercetalia Fagetea</i> class														
<i>Viola alba</i> Besser ssp. <i>dehnhardtii</i> (Ten.) W. Becker	2.2	+2	2.2	1.2	1.2	3.2	+	+	.	1.2	.	2.2	1.2	12
<i>Stachys officinalis</i> (L.) Trevisan	1.2	1.2	.	.	.	.	+	.	1.2	1.2	+2	1.2	+2	8
<i>Oenanthe pimpinelloides</i> L.	+2	.	.	.	.	1.1	+	.	+2	1.2	+2	2.2	.	7
<i>Buglossoides purpureoae</i> (L.) Johnston	1.2	1.2	.	.	.	+2	.	.	1.2	1.2	1.2	2.2	.	7
<i>Hedera helix</i> L.	2.2	1.2	1.2	1.2	1.2	.	+2	.	.	.	+2	.	.	7
<i>Poa sylvicola</i> Guss.	+	.	.	.	.	+2	+2	.	1.2	1.2	.	1.2	.	6
<i>Brachypodium sylvaticum</i> (Hudson) Beauv.	.	2.2	.	.	+2	2.2	.	.	.	.	.	.	.	3
<i>Aristolochia rotunda</i> L.	.	.	.	.	.	.	+	.	.	+	.	+2	.	3
<i>Echinops siculus</i> Strobl	.	.	.	.	.	2.2	.	.	.	.	.	.	.	1
<i>Luzula forsteri</i> (Sm.) DC.	+	.	.	.	.	.	.	.	.	.	.	.	.	1
<i>Cruciata glabra</i> (L.) Ehrend.	.	.	.	.	.	.	.	.	.	.	.	.	+	1
<i>Tamus communis</i> L.	.	.	.	.	.	+2	.	.	.	.	.	.	.	1
Charact. species of the <i>Quercetalia ilicis</i> order and the <i>Quercetalia ilicis</i> class														
<i>Pistacia lentiscus</i> L.	+2	.	+2	.	+2	3.3	1.2	2.2	.	.	1.2	+2	2.3	9
<i>Carex hallerana</i> Asso	1.2	.	1.2	.	1.2	1.2	2.2	.	+2	.	2.2	.	.	7
<i>Clematis flammula</i> L.	.	2.2	.	.	.	.	.	.	1.2	1.2	1.2	3.2	+2	6
<i>Quercus ilex</i> L.	1.1	.	1.2	1.1	1.2	.	.	+	.	.	.	.	.	5
<i>Stipa bromoides</i> (L.) Doerfl.	+2	1.2	.	.	.	.	.	.	.	2.2	1.2	1.2	.	5
<i>Daphne gnidium</i> L.	+	.	.	.	.	.	+	.	.	1.2	+	.	+2	5
<i>Phillyrea media</i> L.	2.2	1.2	.	1.2	.	.	.	.	.	1.2	1.2	.	1.2	5
<i>Osyris alba</i> L.	+2	3.2	.	.	.	.	.	.	+2	.	+	.	+2	5
<i>Melica arrecta</i> O. Kuntze	.	.	.	+	.	+	.	.	.	.	.	.	.	2
<i>Rhamnus alaternus</i> L.	.	.	.	.	.	+	.	.	.	.	.	.	+2	2
<i>Rhamnus saxatilis</i> Jacq. ssp. <i>infectorius</i> (L.) P.Fourn.	.	.	.	.	.	.	.	.	.	+2	.	1.2	.	2
<i>Pistacia terebinthus</i> L.	.	.	.	.	+	.	.	.	.	.	.	.	.	1
<i>Olea europaea</i> L. var. <i>sylvestris</i> Brot.	.	.	.	.	.	.	.	.	.	.	+	.	.	1
<i>Lonicera etrusca</i> Santi	.	+	.	.	.	.	.	.	.	.	.	.	.	1
<i>Prasium majus</i> L.	.	.	.	.	.	.	.	.	.	.	+2	.	.	1
<i>Juniperus oxycedrus</i> L. ssp. <i>macrocarpa</i> (S. et S.) Ball	.	.	.	.	.	.	.	.	.	.	.	.	1.2	1
Charact. species of the <i>Rhamno-Prunetea</i> and <i>Trifolio-Geranietea</i> classes														
<i>Silene italica</i> (L.) Pers.	+	1.2	+2	+2	+2	.	1.2	.	1.2	+2	+	+2	+2	11
<i>Crataegus monogyna</i> Jacq.	1.2	.	.	.	1.2	2.1	.	2.2	1.2	2.2	2.2	1.2	1.2	9
<i>Geranium sanguineum</i> L.	.	1.2	.	1.2	.	3.3	.	.	1.2	+	.	+2	1.2	7
<i>Lathyrus sylvestris</i> L.	.	+	.	.	.	.	.	.	.	+1.2	+	1.2	+	6
<i>Ligustrum vulgare</i> L.	.	.	.	.	.	.	.	.	2.2	1.2	1.2	1.2	.	4
<i>Cornus mas</i> L.	+	+	.	.	.	.	.	.	.	.	.	.	.	2
<i>Rubus ulmifolius</i> Schott	+2	.	.	.	.	1.1	.	.	.	.	.	.	.	2
<i>Prunus spinosa</i> L.	.	.	.	.	.	+2	.	.	.	.	.	.	.	1
<i>Pyrus amygdaliformis</i> Vill.	.	.	.	.	.	.	.	.	.	.	.	.	+	1
Other species														
<i>Allium subhirsutum</i> L.	+	.	+2	1.2	1.2	1.2	+2	+	.	.	+	+2	1.1	10
<i>Teucrium chamaedrys</i> L.	+2	+2	.	.	.	.	1.2	.	+2	1.2	.	+2	+	7
<i>Silene latifolia</i> Poirlet	.	.	+	+2	+2	.	.	.	.	+2	.	+	.	5
<i>Dactylis glomerata</i> L.	.	+	.	.	.	.	+	.	+2	.	.	+2	.	5
<i>Helictotrichon convolutum</i> (Presl) Henrard	+2	+2	.	.	.	.	1.2	.	2.2	.	.	+2	.	5
<i>Daucus broteri</i> Ten.	+	.	.	.	.	+	+2	.	+2	.	.	+	.	5
<i>Helianthemum nummularium</i> (L.) Miller ssp. <i>obscurum</i> (Celak.) Holub	+2	1.2	.	.	.	.	.	.	1.2	+2	+	.	.	5
<i>Euphorbia apios</i> L.	.	.	.	.	.	1.2	1.2	.	2.2	1.2	.	1.2	.	5
<i>Geranium purpureum</i> Vill.	.	.	+2	+	.	+	+2	.	.	.	.	.	.	4
<i>Sanguisorba minor</i> Scop. ssp. <i>muricata</i> (Gremli) Briq.	.	.	.	.	.	+	.	.	+2	+	.	.	+	4
<i>Lathyrus aphaca</i> L.	+	+	.	.	.	.	+	.	.	.	.	.	.	4
<i>Serratula cichoracea</i> (L.) DC. ssp. <i>cichoracea</i>	+	.	.	.	.	.	+2	.	.	+2	.	1.2	.	4
<i>Cistus creticus</i> L. ssp. <i>ericocephalus</i>	.	.	.	.	.	.	1.2	.	.	.	+	.	+	3
<i>Carex flacca</i> Schreber ssp. <i>serrulata</i> (Biv.) Greuter	.	.	.	.	.	1.2	.	+	.	.	.	.	1.2	3
<i>Pulicaria odora</i> (L.) Rechb.	.	.	.	.	.	1.2	+2	.	.	.	.	.	1.2	3
<i>Galium aparine</i> L.	.	.	.	.	.	.	1.2	.	+	+2	.	.	.	3
<i>Trifolium pratense</i> L.	.	.	.	.	.	.	+2	.	.	+2	.	+	.	3
Accidental species														
	2	2	2	3	1	6	3	1	2	7	1	4	3	

collina, *Teucrium siculum*, *Carpinus orientalis* and *Clematis flammula*.

This same vegetation penetrates into the “gravine”, colonising, therefore, a decidedly more humid environment, in which there is almost always a high presence of *Festuca exaltata* and *Acer monspessulanum* and a relative increase in *Carpinus orientalis*. Together, these species differentiate a more mesophilous variant of the association.

Among the Balcan associations of *Quercus trojana*, Horvát *et al.* (1974) described for Macedonia a *Quercetum trojanae* Em 1958 em. Horvát 1959 that is less thermophilous than *Euphorbio apii-Quercetum trojanae* and that is referred to the *Carpinion orientalis* alliance of the *Quercetalia pubescenti-petraeae* order.

Although it has a good number of Mediterranean species of the *Quercetea ilicis* class, the community under study in the area of Matera and Laterza Murge forms part of a typically mesophilous context that allows the ingression of several species of the *Quercu-Fagetea* class, among which there are *Carpinus orientalis*, *Stachys officinalis*, *Acer monspessulanum*, *Oenanthe pimpinelloides*, etc.; moreover, these woods are structurally surrounded by typical plant communities of the forest edge classes: *Rhamno-Prunetea* and *Trifolio-Geranietea*. This makes evident, therefore, a group of floristic elements with different significance that together allow the attribution of this association to the *Quercetalia pubescenti-petraeae* order, within which we propose to include it in the *Carpinion orientalis* alliance and in the *Lauro nobilis-Quercenion pubescentis* suballiance, which is thus differentiated by the ingression of Mediterranean species, especially vines, such as: *Rubia peregrina* var. *longifolia*, *Rosa sempervirens*, *Clematis flammula* and *Smilax aspera*.

The *Quercus virgiliana* woods

Quercus virgiliana is found mainly in the south of Italy, including the islands, and on the Balcan peninsula. It is a species that is indifferent to the substratum, with a high ecological plasticity and a resistance to dryness. It participates in the structure of mixed woods of deciduous and evergreen oaks with a mainly thermophilous character (Brullo *et al.*, 1999) that have been referred to several associations, some of which are attributed to the *Quercetalia ilicis* order and others to the *Quercetalia pubescentis* one.

In Apulia, there are two types of woods with a dominance of *Quercus virgiliana* that are referred to the same number of associations: *Irido collinae-Quercetum*

virgiliana ass. nova and *Cyclamino hederifolii-Quercetum virgiliana* ass. nova. The potential distribution of Apulian *Quercus virgiliana* woods is shown in Fig. 12.

IRIDO COLLINAE-QUERCETUM VIRGILIANAE ass. nova

(type rel. n. 3 of Tab. 7)

To this association there can be attributed a part of the present “Bosco dell’Incoronata” that extends for around 20 ha in the Foggia Tavoliere, near the Convento dell’Incoronata, and that is thought to represent the last remnants of the original vegetation that covered the Apulian plains. A 1:10,000 scale map of the vegetation of the plain of Tavoliere, crossed in this area by the Cervaro River, has been produced (Pedrotti & Venanzoni, 1994). On the basis of this document, a hygrophilous vegetation has developed on the banks of the river, with a dominance of *Ulmus minor* referred to the *Aro italici-Ulmetum minoris* association and of *Fraxinus oxycarpa* of the *Ranunculo-Fraxinetum oxycarpae* association, as well as river-bed formations of *Populetum albae*, *Salicetum albae*, *Salicetum triandrae*, and *Saponario-Salicetum purpureae*. For the higher alluvial terraces with sandy-muddy soils, the map shows the distribution of woods that are indicated as *Quercus pubescens* s.l. woods. These are aging coppice woods with huge centuries-old examples of *Quercus virgiliana* and some of *Q. amplifolia*, and with a considerable vine cover. The phytosociological relevés reported in Tab. 7 were carried out in these woods. From this Table, the thermomesophilous character of the vegetation can be clearly seen by the presence of numerous species of the *Quercetea ilicis* class (*Clematis flammula*, *Asparagus acutifolius*, *Smilax aspera*, *Euphorbia characias*, *Rosa sempervirens*, etc.), while the presence of a not very deep water-table results in humid soil conditions also during the summer period, seen by the presence of a dense vegetation covering of *Crataegus monogyna* and *Ligustrum vulgare*. The characteristic and differential species of the new *Irido collinae-Quercetum virgiliana* association are: *Iris collina*, *Cercis siliquastrum*, *Ulmus minor*, *Euphorbia characias*, *Clematis flammula*, *Stipa bromoides*, *Quercus virgiliana* and *Q. dalechampii*.

With regard to the attribution to the upper hierarchical levels, according to the new revision of the *Quercetalia pubescenti-petraeae* order (Blasi *et al.*, 2004), it is thought that the association should be referred to the *Quercetalia pubescenti-petraeae* order, to the *Pino calabrica-Quercenion congestae* alliance and to the *Quercenion virgiliana* suballiance.

Tab. 7 - *Irido collinae-Quercetum virgilianae* ass. nova

Rel. n.	1	2	3*	4	P
Altitude (m)	70	70	70	70	r
Exposure	-	-	-	-	e
Slope (°)	-	-	-	-	s.
High of the tree layer (m)	12-15	12	15	12	
Coverage (%)	100	100	100	100	
Area (m ²)	200	200	250	250	
Charact. and diff. species of the association					
<i>Quercus virgiliana</i> (Ten.) Ten.	5.5	5.5	5.5	5.5	4
<i>Quercus dalechampii</i> Ten.	1.2	2.2	2.2	1.2	4
<i>Cercis siliquastrum</i> L.	2.3	+	2.2	1.2	4
<i>Euphorbia characias</i> L.	1.1	+	1.2	1.2	4
<i>Clematis flammula</i> L.	1.2	2.2	2.2	1.2	4
<i>Ulmus minor</i> Miller	.	1.2	1.2	1.2	3
<i>Stipa bromoides</i> (L.) Doerfl.	2.2	1.2	+	.	3
<i>Iris collina</i> Terr.	2.3	.	1.2	+2	3
<i>Quercus amplifolia</i>	.	.	+	.	1
Charact. species of the upper units					
<i>Buglossoides purpuracaerulea</i> (L.) Johnston	2.2	2.3	2.2	3.3	4
<i>Viola alba</i> Besser ssp. <i>dehnhardtii</i> (Ten.) W. Becker	1.1	+	+	+	4
<i>Brachypodium sylvaticum</i> (Hudson) Beauv.	+	1.2	2.2	2.2	4
<i>Hedera helix</i> L.	2.3	2.3	2.3	2.3	4
<i>Oenanthe pimpinelloides</i> L.	.	+	+	.	2
<i>Rosa arvensis</i> Hudson	.	.	+2	+	2
<i>Crataegus oxyacantha</i> L.	.	+2	1.2	.	2
<i>Acer campestre</i> L.	.	1.2	.	.	1
Charact. species of the <i>Rhamno-Prunetea</i> class					
<i>Crataegus monogyna</i> Jacq.	1.2	2.2	1.2	3.4	4
<i>Ligustrum vulgare</i> L.	+2	1.2	1.2	2.3	4
<i>Prunus spinosa</i> L.	+	.	+	1.2	3
<i>Euonymus europaeus</i> L.	.	+	+2	1.2	3
<i>Rubus ulmifolius</i> Schott	.	1.2	1.2	.	2
<i>Clematis vitalba</i> L.	.	.	+2	2.2	2
<i>Cornus sanguinea</i> L.	.	+	.	.	1
Other species					
<i>Asparagus acutifolius</i> L.	2.2	2.2	1.2	2.2	4
<i>Carex hallerana</i> Asso	2.2	1.2	2.3	+	4
<i>Rubia peregrina</i> L. var. <i>longifolia</i> Poiret	1.2	2.2	2.2	1.2	4
<i>Ruscus aculeatus</i> L.	2.3	2.2	2.3	2.2	4
<i>Rosa sempervirens</i> L.	1.2	2.3	2.2	1.2	4
<i>Carex flacca</i> Schreber	+2	+	+	1.2	4
<i>Smilax aspera</i> L.	1.2	3.4	3.4	1.2	3
<i>Osyris alba</i> L.	.	1.1	1.2	1.1	3
<i>Scilla autumnalis</i> L.	.	+	+2	+	3
<i>Oryzopsis miliacea</i> (L.) Asch. et Sch. ssp. <i>thomasi</i> (Duby) Pign.	.	1.2	+2	+2	3
<i>Lonicera etrusca</i> Santi	.	+	+2	.	2
Accidental species	-	-	4	2	

CYCLAMINO HEDERIFOLII-QUERCETUM VIRGILIANAE ass. nova

(type rel. n. 4 of Tab. 8)

This association has been found in some localities of Gargano and in the warmer sectors of the subApennines of Daunia. These are thermomesophilous woods that grow in an upper Mesomediterranean and Submediterranean bioclimate and occupy the low-slope aspects of a mainly northern exposure on quite deep calcareous soils belonging to the "terre rosse" type. They are coppice woods within which there are sometimes *Fraxinus ornus*, *Quercus dalechampii*, *Q. ilex* and

Carpinus orientalis. The association is found in chain contact with the holm oak woods of the *Cyclamino hederifolii-Quercetum ilicis* association. In the new association, it is possible to recognise the role of the geographic substitute of *Rosa sempervirentis-Quercetum pubescentis* of central Italy.

The characteristic and differential species are: *Cyclamen hederifolium*, *Pistacia terebinthus*, *Clematis flammula* and *Euphorbia characias*.

From a comparison with the other associations of *Quercus virgiliana*, the greatest analogies are with the association of the mixed evergreen and deciduous wood

Aceri monspessulani-Quercetum virgilianae Brullo, Scelsi & Spampinato 2001, described for the rocky calcareous substrata of the hilly belt of Aspromonte, with respect to which in the Apulian association an absence of some thermophilous species can be seen, such as: *Cyclamen repandum*, *Euphorbia dendroides*, *Clematis cirrhosa*, *Arisarum vulgare* and *Prasium majus*, while the following are absent: *Fraxinus ornus*, *Carpinus orientalis*, *Ostrya carpinifolia*, *Festuca exaltata*, *Quercus cerris*, *Q. dalechampii*, *Acer campestre*, *Rosa arvensis*, *Viola alba* ssp. *dehnhardtii*, *Buglossoides purpureocaerulea*, *Stachys officinalis*, etc. A certain analogy can also be seen with the Balcan *Ostryo-Quercetum virgilianae* Trinajstić 1987 association, described for the coastal mountain system of Biokovo, in Croatia, which is, however, a lot more mesophilous and montane in that it is richer in mesophilous elements and species of the *Fagetalia* order, such as: *Fagus sylvatica*, *Euonymus latifolius*, *Melica uniflora*, *Aremonia agrimonioides* and *Athyrium filix-foemina*, and that can equally be attributed to the *Quercetalia pubescenti-petraeae* order and to the *Carpinion orientalis* alliance.

The *Quercus dalechampii* woods

This species, diffuse throughout Italy, including the islands, and in the Balcan peninsula, grows on siliceous substrata in positions of Supra- and Mesomediterranean

bioclimate, with penetrations into the Submediterranean, participating in the formation of mixed woods. The potential distribution of *Quercus dalechampii* woods of Apulia is shown in Fig. 12.

STIPO BROMOIDIS-QUERCETUM DALECHAMPII ass. nova

(type rel. n. 2 of Tab. 9)

This association refers to the woods that grow in the north-western sectors of Murge, made up of a calcareous high-plain of the Calcari di Altamura formation, with “terra rossa”, above 200 m. These woods are dominated by *Quercus dalechampii* and *Quercus virgiliana* and are today found reduced to remnant strips because of the intense exploitation for coppicing and pasturing. They are consequently found to be largely degraded and interrupted by shrubby and grassland areas that have the same vegetational potentiality. Relatively mesophilous species of the *Quercetalia pubescenti-petraeae* order contribute to their floristic composition.

The characteristic and differential species of the new *Stipo bromoidis-Quercetum dalechampii* association are: *Stipa bromoides*, *Crataegus laevigata*, *Lonicera etrusca*, *Quercus virgiliana*, *Carex hallerana*, and *Iris collina*.

For Sicily and southern Italy, the *Quercenion dalechampii* Brullo 1984 suballiance, of the *Erico-Quercenion ilicis* Brullo, Di Martino & Marcenò 1977 alliance has been described, the characteristic and differential species of which are: *Quercus dalechampii*, *Q. congesta*, *Festuca exaltata*, *Echinops sicalus*, *Symphytum gussonei*, *Pimpinella anisoides* and *Melittis albida*, and to which it is thought the new association cannot be referred. There have been no other associations described for *Quercus dalechampii* in the literature, while for the territory of the Terni Province the *quercetosum dalechampii* subassociation of the *Roso sempervirentis-Quercetum pubescentis* association has been described, which is floristically very impoverished (Biondi, Gigante *et al.*, 2002). This last refers to pioneer woods on very steep marl substrata (silty marls and shales, such as “argille scagliose”) that are subjected to gully erosion, and which have been attributed to the *Carpinion orientalis* alliance and to the *Lauro nobilis-Quercenion pubescentis* suballiance, to which it is thought that also the new association should be referred.

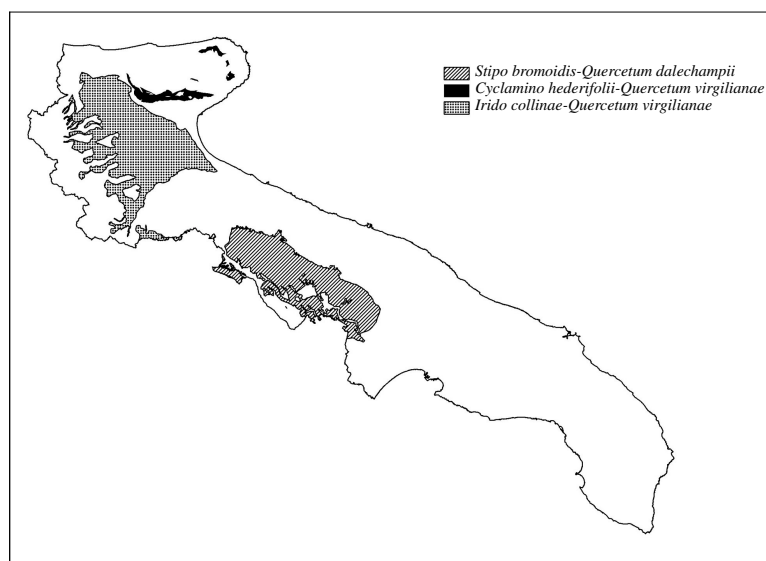


Fig. 12 - Potential distribution of the *Quercus virgiliana* and *Q. dalechampii* woods in Apulia

Tab. 8 - *Cyclamino hederifolii-Quercetum virgiliana* ass. nova

Rel. n.	1	2	3	4*	5	6	P
Altitude (m)	310	380	540	210	260	430	r
Exposure	SE	-	NE	NW	N	NNE	e
Slope (°)	5	-	5	30	30	30-35	s.
High of the tree layer (m)	6-8m	10	17	15	10	8-12m	
Coverage (%)	95	90	90	100	100	95	
Area (m ²)	200	200	250	200	300	200	
Charact. and diff. species of the association							
<i>Quercus virgiliana</i> (Ten.) Ten.	3.3	4.4	4.4	4.5	4.4	5.5	6
<i>Viola alba</i> Besser ssp. <i>dehnhardtii</i> (Ten.) W. Becker	1.2	+	2.3	1.2	2.3	1.2	6
<i>Clematis flammula</i> L.	+	+	2.2	1.2	2.2	.	5
<i>Cyclamen hederifolium</i> Aiton	.	.	.	1.2	1.2	+	3
<i>Pistacia terebinthus</i> L.	.	.	.	2.2	1.2	1.2	3
<i>Euphorbia characias</i> L.	.	.	.	+	+	2.2	3
<i>Festuca drymeia</i> M. et K.	.	.	2.3	.	(+2)	.	2
Charact. species of the <i>Carpinion orientalis</i> all. and the <i>Lauro nobilis-Quercenion pubescentis</i> suball.							
<i>Asparagus acutifolius</i> L.	1.1	1.1	+	1.2	2.2	2.2	6
<i>Ruscus aculeatus</i> L.	1.2	2.2	3.3	2.3	2.3	2.3	6
<i>Fraxinus ornus</i> L.	2.2	3.3	.	1.2	2.3	1.2	5
<i>Phillyrea media</i> L.	.	.	+	+2	+	+	4
<i>Rosa sempervirens</i> L.	1.2	1.1	.	2.2	2.3	.	4
<i>Rubia peregrina</i> L. var. <i>longifolia</i> Poirlet	+	1.1	1.2	.	.	.	3
<i>Brachypodium sylvaticum</i> (Hudson) Beauv.	+2	.	.	1.2	1.2	.	3
<i>Carpinus orientalis</i> Miller	2.2	+	.	.	4.4	.	3
<i>Smilax aspera</i> L.	.	.	.	3.4	2.3	.	2
<i>Hippocrepis emerus</i> (L.) Lassen ssp. <i>emeroides</i> (Boiss. et Spruner) Lassen	.	.	.	.	(+2)	1.2	2
<i>Rhamnus alaternus</i> L.	.	.	.	+2	+	.	2
<i>Ostrya carpinifolia</i> Scop.	.	.	2.3	1.2	.	.	2
<i>Quercus dalechampii</i> Ten.	.	.	.	.	2.3	.	1
<i>Quercus trojana</i> Webb	.	.	.	.	.	+	1
Charact. species of the <i>Quercetalia pubescenti-petraeae</i> order and the <i>Quercio-Fagetea</i> class							
<i>Buglossoides purpuracaerulea</i> (L.) Johnston	1.1	1.1	.	1.2	1.2	+	5
<i>Stachys officinalis</i> (L.) Trevisan	+	+	+2	+	1.2	.	5
<i>Acer campestre</i> L.	+	+	+	+	.	.	4
<i>Hedera helix</i> L.	.	.	1.2	+2	1.2	.	3
<i>Geum urbanum</i> L.	+	+	+2	.	.	.	3
<i>Quercus cerris</i> L.	3.3	.	2.2	.	+2	.	3
<i>Pyrus pyraeaster</i> Burgsd.	+	.	.	.	.	+	2
<i>Tamus communis</i> L.	.	+	.	.	.	1.1	2
<i>Poa sylvicola</i> Guss.	1.2	+	.	.	.	.	2
<i>Quercus pubescens</i> Willd.	.	.	1.1	.	.	.	1
<i>Rosa arvensis</i> Hudson	.	.	1.2	.	.	.	1
<i>Oenanthe pimpinelloides</i> L.	.	.	1.1	.	.	.	1
<i>Teucrium siculum</i> Rafin.	.	.	.	.	+2	.	1
<i>Lathyrus venetus</i> (Miller) Wohlf.	.	.	1.2	.	.	.	1
<i>Daphne laureola</i> L.	.	.	1.1	.	.	.	1
<i>Euphorbia amygdaloides</i> L.	.	.	1.2	.	.	.	1
<i>Sorbus torminalis</i> (L.) Crantz	.	.	+	.	.	.	1
<i>Sorbus domestica</i> L.	.	.	.	.	.	+	1
<i>Anemone apennina</i> L.	+2	.	.	.	.	.	1
<i>Luzula forsteri</i> (Sm.) DC.	.	+	.	.	.	.	1
<i>Helleborus foetidus</i> L.	+	.	.	.	.	.	1
<i>Stellaria holostea</i> L.	+	.	.	.	.	.	1
<i>Fraxinus excelsior</i> L.	.	.	1.2	.	.	.	1
<i>Quercus frainetto</i> Ten.	.	.	.	.	1.2	.	1
<i>Doronicum orientale</i> Hoffm.	+	.	.	.	.	.	1
<i>Luzula sylvatica</i> (Hudson) Gaudin	+2	.	.	.	.	.	1
<i>Cornus mas</i> L.	.	.	.	+	.	.	1
Charact. species of the <i>Rhamno-Prunetea</i> class							
<i>Crataegus monogyna</i> Jacq.	1.1	+	2.2	1.2	1.2	2.3	6
<i>Rosa canina</i> L. sensu Bouleng.	.	.	+	+	.	1.2	3
<i>Ligustrum vulgare</i> L.	+2	.	.	+2	.	1.2	3
<i>Euonymus europaeus</i> L.	+	+	.	.	.	+	3
<i>Prunus spinosa</i> L.	.	.	.	.	+	1.2	2
<i>Rubus ulmifolius</i> Schott	.	.	+	.	.	+	2
<i>Cornus sanguinea</i> L.	1.1	+	.	.	.	.	2
<i>Clematis vitalba</i> L.	.	.	.	.	+	.	1
<i>Rhamnus saxatilis</i> Jacq. ssp. <i>infectorius</i> (L.) P.Fourn.	.	.	.	.	.	+	1
<i>Paliurus spina christi</i> Miller	.	.	.	2.3	.	.	1
<i>Lonicera caprifolium</i> L.	.	+	.	.	.	.	1
<i>Chamaecytisus hirsutus</i> (L.) Link	.	.	.	.	+2	.	1
<i>Colutea arborescens</i> L.	.	.	.	.	.	+	1
<i>Cotinus coggygria</i> Scop.	.	.	.	.	+	.	1
Charact. species of the <i>Quercetea ilicis</i> class							
<i>Carex hallerana</i> Asso	1.1	.	2.2	1.2	1.2	+	5
<i>Quercus ilex</i> L.	.	.	1.2	1.2	1.1	+2	4
<i>Lonicera etrusca</i> Santi	.	.	.	.	+	1.2	2
<i>Lonicera implexa</i> Aiton	.	.	.	+2	.	.	1
<i>Asplenium onopteris</i> L.	.	.	.	.	+	.	1
<i>Stipa bromoides</i> (L.) Doerfl.	.	.	.	.	.	+	1

Other species						
<i>Silene italica</i> (L.) Pers.	+	+2	1.2	(+)	+	5
<i>Osyris alba</i> L.	2.2	2.2	.	+	.	3
<i>Allium subhirsutum</i> L.	.	.	+	.	+	3
<i>Agrimonia eupatoria</i> L.	.	+	1.2	.	+2	3
<i>Carex flacca</i> Schreber	.	.	+2	1.2	.	2
<i>Brachypodium rupestre</i> (Host) R. et S.	.	+	.	.	+	2
<i>Fragaria vesca</i> L.	.	.	+	.	+	2
<i>Ranunculus bulbosus</i> L.	+	+	.	.	.	2
<i>Ornithogalum pyrenaicum</i> L.	1.1	+	.	.	.	2
<i>Leopoldia comosa</i> (L.) Parl.	+	+	.	.	.	2
<i>Clinopodium vulgare</i> L.	.	.	+	.	.	1
Accidental species	6	8	2	1	1	1

Tab. 9 - *Stipo bromoidis-Quercetum dalechampii* ass. nova

Rel. n.	1	2*	3	4	5	P
Altitude (m)	410	390	380	460	460	r
Exposure	E	SW	-	E	NNE	e
Slope (°)	5	5	-	20	15	s.
High of the tree layer (m)	6	8	10	8	10	
Coverage (%)	90	100	100	100	100	
Area (m ²)	200	250	200	150	150	
Charact. and diff. species of the association						
<i>Quercus dalechampii</i> Ten.	3.3	5.5	4.5	4.4	5.5	5
<i>Stipa bromoides</i> (L.) Doerfl.	1.2	2.2	2.2	+	+2	5
<i>Crataegus oxyacantha</i> L.	1.2	2.2	2.3	1.2	1.2	5
<i>Lonicera etrusca</i> Santi	+2	2.2	2.2	+	+	5
<i>Carex hallerana</i> Asso	.	2.3	2.3	2.3	2.3	4
<i>Quercus virgiliana</i> (Ten.) Ten.	4.4	+2	2.2	.	.	3
<i>Iris collina</i> Terr.	+2	+2	.	.	.	2
Charact. species of the <i>Carpinion orientalis</i> all. and the <i>Lauro nobilis-Quercenion pubescentis</i> suball.						
<i>Asparagus acutifolius</i> L.	2.3	2.3	2.2	1.2	1.2	5
<i>Rubia peregrina</i> L. var. <i>longifolia</i> Poiret	2.2	2.2	3.3	1.2	+2	5
<i>Rosa sempervirens</i> L.	.	+	1.2	.	+2	3
<i>Quercus pubescens</i> Willd.	.	.	.	2.3	2.3	2
<i>Ruscus aculeatus</i> L.	.	.	.	+	.	1
Charact. species of the <i>Quercetalia pubescenti-petraeae</i> order and the <i>Quercio-Fagetea</i> class						
<i>Buglossoides purpureoaeerulea</i> (L.) Johnston	1.2	1.2	2.3	3.3	2.3	5
<i>Brachypodium sylvaticum</i> (Hudson) Beauv.	.	+2	+2	1.2	2.3	4
<i>Geum urbanum</i> L.	.	.	.	1.2	1.2	2
<i>Viola alba</i> Besser ssp. <i>dehnhardtii</i> (Ten.) W. Becker	.	.	.	2.3	.	1
<i>Rosa arvensis</i> Hudson	.	.	.	+2	.	1
<i>Quercus cerris</i> L.	.	.	.	+	.	1
<i>Mespilus germanica</i> L.	+	.	.	.	.	1
Charact. species of the <i>Rhamno-Prunetea</i> class						
<i>Rosa canina</i> L. sensu Bouleng.	1.2	2.2	2.2	1.2	1.2	5
<i>Crataegus monogyna</i> Jacq.	2.3	1.2	1.2	3.3	3.3	5
<i>Prunus spinosa</i> L.	.	1.2	1.2	2.2	3.4	4
<i>Rubus ulmifolius</i> Schott	.	+	+	+	+2	4
<i>Pyrus amygdaliformis</i> Vill.	1.2	1.2	+	.	+2	4
<i>Rhamnus saxatilis</i> Jacq. ssp. <i>infectorius</i> (L.) P.Fourn.	1.2	1.2	.	.	+2	3
<i>Ligustrum vulgare</i> L.	.	.	.	+	2.3	2
<i>Pyrus pyraeaster</i> Burgsd.	.	+	.	.	+	2
<i>Prunus webbii</i> (Spach) Vierh.	+	+	.	.	.	2
<i>Prunus mahaleb</i> L.	.	.	.	.	1.2	1
Other species						
<i>Carex flacca</i> Schreber	1.2	1.2	1.2	+2	+	5
<i>Teucrium chamaedrys</i> L.	+2	+2	1.2	+	+2	5
<i>Osyris alba</i> L.	2.3	1.2	.	+	+	4
<i>Silene italica</i> (L.) Pers.	1.2	1.1	.	+	+	4
<i>Clinopodium vulgare</i> L.	.	+2	+	+2	1.1	4
<i>Cyclamen hederifolium</i> Aiton	+	+	1.1	.	.	3
<i>Allium subhirsutum</i> L.	1.1	+	1.1	.	.	3
<i>Agrimonia eupatoria</i> L.	.	+2	.	2.2	+	3
<i>Scilla autumnalis</i> L.	+	+	.	+	.	3
<i>Pistacia terebinthus</i> L.	1.2	+2	.	.	.	2
<i>Asphodeline liburnica</i> (Scop.) Rchb.	+	.	+	.	.	2
<i>Melica transsylvanica</i> Schur	1.1	1.1	.	.	.	2
<i>Potentilla hirta</i> L.	+	.	.	+	.	2
Accidental species	6	-	2	2	-	

Syntaxonomic scheme of the Apulian forest vegetation

A syntaxonomic scheme summarising the forest typologies present in Apulia is here proposed that can, at present, be considered complete.

Quercetea ilicis Br.-Bl. ex A. & O. Bolòs 1950

Quercetalia ilicis Br.-Bl. ex Molinier 1934

Fraxino orni-Quercion ilicis Biondi, Casavecchia & Gigante 2003

Fraxino orni-Quercenion ilicis Bacchetta, Bagella, Biondi, Farris, Filigheddu & Mossa 2003

Festuco exaltatae-Quercetum ilicis Biondi, Casavecchia & Gigante 2003

festucetosum exaltatae Biondi, Casavecchia & Gigante 2003

carpinetosum orientalis subass. nova

Cyclamino hederifolii-Quercetum ilicis Biondi, Casavecchia & Gigante 2003

cyclaminetosum hederifolii Biondi, Casavecchia & Gigante 2003

carpinetosum orientalis Biondi, Casavecchia & Gigante 2003

myrtetosum communis subass. nova

Cephalanthero longifoliae-Quercetum ilicis Biondi & Venanzoni ex Biondi, Gigante, Pignattelli & Venanzoni 2002

lauretosum nobilis Biondi, Casavecchia & Gigante 2003

Hedero helicis-Quercetum calliprini ass. nova

Carici halleranae-Quercetum suberis ass. nova

Euphorbio apii-Quercetum trojanae Bianco, Brullo, Minissale, Signorello & Spampinato 1998

quercetosum trojanae subass. nova

poetosum sylvicolae Bianco, Brullo, Minissale, Signorello & Spampinato 1998

Pistacio lentisci-Rhamnietalia alaterni Rivas-Martínez 1975

Oleo-Ceratonion siliquae Br.-Bl. ex Guinochet & Drouineau 1944

Arbuto-Quercetum calliprini Brullo, Minissale, Signorello & Spampinato 1987

Pistacio lentisci-Pinetum halepensis De Marco, Veri & Caneva 1984

Plantago albicans-Pinetum halepensis De Marco, Veri & Caneva 1984

Thymo capitati-Pinetum halepensis De Marco & Caneva 1984

thymetosum striati Bartolo, Brullo, Minissale & Spampinato 1985

Cyclamino hederifolii-Pinetum halepensis ass. nova

Querco-Fagetea Br.-Bl. & Vlieger in Vlieger 1937

Quercetalia pubescenti-petraeae Klika 1933

Carpinion orientalis Horvát 1958

Lauro nobilis-Quercenion pubescentis Ubaldi 1995

Cyclamino hederifolii-Quercetum virgiliana ass. nova

Stipo bromoidis-Quercetum dalechampii ass. nova

Teucro siculi-Quercetum trojanae ass. nova

Pino calabrica-Quercion congestae Brullo, Scelsi, Siracusa & Spampinato 1999

Quercenion virgiliana Blasi, Di Pietro & Filesi 2004

Irido collinae-Quercetum virgiliana ass. nova

Acknowledgements

The Authors would like to thank Prof. Nello Biscotti (Vico del Gargano) for his participation in the carrying out of the phytosociological relevées in the Gargano area.

References

- Agostini R., 1967. Osservazioni fitosociologiche sulle pinete a *Pinus halepensis* Mill. nel territorio di Taranto. Arch. Bot. e Biogeograf. Ital. 43: 337-401. Forlì.
- Andenberg M.R., 1973. Cluster Analysis for Application. Academic Press, New York.
- Bacchetta G., Bagella S., Biondi E., Farris E., Filigheddu R. & Mossa L., 2004. A contribution to the knowledge of the order *Quercetea ilicis* Br.-Bl. ex Molinier 1934 of Sardinia. Fitosociologia 41 (1): 29-51.
- Baldacci A., 1894. Rivista critica della collezione botanica fatta nel 1892 in Albania. Malpighia.
- Bartolo G., Brullo S., Minissale P. & Spampinato G., 1985. Osservazioni fitosociologiche sulle pinete a *Pinus halepensis* Miller del bacino del Fiume Tellaro (Sicilia sud-orientale). Boll. Acc. Gioenia Sci. Nat. Catania 18 (325): 255-270.
- Bianco P., Brullo S., Minissale P., Signorello P. & Spampinato G., 1998. Considerazioni fitosociologiche sui boschi a *Quercus trojana* Webb della Puglia (Italia meridionale). Studia Geobotanica 16: 33-38.
- Bianco P., Castellano M.A., Piro G. & Schirone B., 1981-82. Sulla distribuzione della quercia spinosa in Puglia. Annali della facoltà di Agraria dell'Università di Bari XXXII: 255-291.
- Biondi E., 1985. Indagine fitosociologica sulle cenosi riferibili alla classe *Quercetea ilicis* presenti sul promontorio del Gargano (Adriatico meridionale). Not. Fitosoc. 22: 59-76.
- Biondi E., Casavecchia S. & Gigante D., 2003. Contribution to the syntaxonomic knowledge of the *Quercus ilex* L. woods of the Central European Mediterranean Basin. Fitosociologia 40 (1): 129-156.
- Biondi E., Casavecchia S., Pinzi M., Allegranza M. & Baldoni M., 2002. The syntaxonomy of the mesophilous woods of the Central and Northern Apennines (Italy). Fitosociologia 39 (2): 71-93.
- Biondi E., Gigante D., Pignatelli S. & Venanzoni R., 2002. I boschi del piano collinare della Provincia di Terni. Fitosociologia 39 (1): 135-160.
- Blasi C., Di Pietro R., Filesi L., 2004. Syntaxonomical revision of *Quercetalia pubescenti-petraeae* in the Italian Peninsula. Fitosociologia 41 (1): 87-164.
- Boissier E., 1879. Flora Orientalis. IV, Genevae et Basileae.
- Bolós De O., Masalles R. M., Ninot J. M. & Vigo J., 1996. A survey on the vegetation of Cephalonia (Ionian islands). Phytocoenologia 26 (1): 81-123.
- Brullo S., Guarino R. & Siracusa G., 1999. Revisione tassonomica delle querce caducifoglie della Sicilia. Webbia 54 (1): 1-72.
- Brullo S., Minissale P., Signorello P. & Spampinato G., 1986. Studio fitosociologico delle garighe ad *Erica manipuliflora* del Salento (Puglia meridionale). Arch. Bot. e Biogeograf. Ital. 62 (3-4): 201-214.
- Camus A., 1936-1938. Les Chênes, Monographie du genre *Quercus*. Lechevalier, Paris.
- Caniglia C., Chiesura Lorenzoni F., Curti L., Lorenzoni G. G., Marchiori S., Razzara S., & Tornadore Marchiori N., 1984. Contributo allo studio fitosociologico del Salento meridionale (Puglia - Italia meridionale). Arch. Bot. e Biogeograf. Ital. 60 (1-2): 1-40.
- Chiesura Lorenzoni F., Curti L. & Lorenzoni G. G., 1971. Considerazioni sulle cenosi a *Quercus calliprinos* Webb e a *Q. macedonica* DC. in Puglia. Atti 1° Simp. Naz. Cons. Nat., Bari, 21-25 aprile 1971: 255-262.
- Chiesura Lorenzoni F., Curti L., Lorenzoni G. G., Lucato A. & Marchiori S., 1974. Ricerche fitosociologiche sulle cenosi a quercia spinosa del Salento (Puglia). Not. Fitosoc. 8: 45-64.
- Cirino E., Ferrauto G. & Longhitano N., 1998. Contributo alla conoscenza della vegetazione dell'area "Cava Risicone-Bosco Pisano" (Monti Iblei-Sicilia). Fitosociologia 35: 33-50.
- Corti R., 1954. Ricerche sul ciclo riproduttivo di specie del genere *Quercus* della flora italiana. I. Osservazioni sul ciclo riproduttivo in *Quercus coccifera* L. Ann. Acc. Ital. Sc. Forest. 2: 235-264.
- Corti R., 1967. La quercia spinosa in Puglia e il problema della sua posizione sistematica. Arch. Bot. Biogeogr. It. 4 s. 12: 321-326.
- Crivellari D., 1950. Inchiesta sulla distribuzione del genere *Quercus* in Puglia. Nuovo Giorn. Bot. Ital. n.s. 57: 335-350.
- Curti L., Lorenzoni G. G., Marchiori S. & Stevan S., 1974. Osservazioni fitosociologiche sulle cenosi a *Quercus ilex* L. e a *Rosmarinus*, *Erica*, *Cistus*, del litorale di Lesina (Foggia). Not. Soc. Ital. Fitosoc. 8: 29-44.
- De Candolle A., 1864. *Cupuliferae*. In A. P. De Candolle's Prodrromus Systematis Naturalis Regni Vegetabilis 16 (2): 1-123.
- De Halacsy E., 1904. Conspectus Florae Graecae. III. Lipsia.
- De Marco G. & Caneva G., 1984. Analisi sintassonomica e fitogeografica comparata di alcune significative cenosi a *Pinus halepensis* Mill. in Italia. Not. Fitosoc. 19 (I): 155-176.

- De Marco G., Veri L. & Caneva G., 1984. Analisi fitosociologica, cartografia della vegetazione e trasformazioni ambientali nel periodo 1955-1981 delle isole Tremiti (Adriatico centro-meridionale). *Ann. Bot. (Roma)* 42 (suppl. 2): 17-47. Roma.
- Falinski J. B. & Pedrotti F., 1990. The vegetation and dynamical tendencies in the vegetation of Bosco Quarto, Promontorio del Gargano, Italy. *Braun-Blanquetia* 5: 3-31. Camerino.
- Fiori A., 1923-1929. *Nuova Flora Analitica d'Italia*. Firenze.
- Francini Corti E., 1966. Aspetti della vegetazione pugliese e contingente paleogeico meridionale nella Puglia. *Annali Accad. Ital. Sci. Forestali* 15: 137-194.
- Francini Corti E., 1967. Problemi di Fitogeografia della Puglia. *Arch. Bot. Biogeograf. Ital.* 43 (4): 195-226.
- Francini E., 1953. Il Pino d'Aleppo in Puglia. *Annali della Facoltà di Agraria dell'Università di Bari* vol. VIII: 309-416. Bari.
- Gentile S., 1962. Frammenti di macchia particolarmente con *Q. calliprinos* Webb nel territorio di Ragusa. *Delpinoa*, n. s. IV: 127-144.
- Horvát I., Glavač V. & ElleMBERG H., 1974. Vegetation Südosteuropas. *Geobotanica selecta*, 4. Fisher, Stuttgart.
- Jalas J., Suominen J., 1976. *Atlas Florae Europaeae*. Vol. 3. Helsinki.
- Lorenzoni G. G. & Ghirelli L., 1988. Lineamenti della vegetazione del Salento (Puglia meridionale - Italia). *Thalassia Salentina* II: 11-19.
- Lorenzoni G. G., 1967a. Ricerche floristico-fitogeografiche sulla costa jonica delle Puglie programmate dall'Istituto Botanico dell'Università di Padova. *Thalassia Salentina* 2: 161-164.
- Lorenzoni G. G., 1967b. Cenni sui primi risultati delle ricerche floristiche e fitogeografiche dell'Istituto Botanico dell'Università di Padova nel Salento. *Giorn. Bot. Ital.* 101: 424-425.
- Lorenzoni G. G., 1978. La vegetazione naturale nell'assetto territoriale del Salento. In: U. Leone - Risorse ambientali e sviluppo economico del Salento. (Atti Conv. Salvaguardia Ambiente nel Mezzogiorno, Lecce 5-7 ottobre 1977). Edizioni Scientifiche Italiane, Napoli: 207-219.
- Lorenzoni G. G., Marchiori S., Caniglia G., Chiesura Lorenzoni F., Curti L., Razzara S., Sburlino G. & Tornadore N., 1984. Escursione in Salento della Società Italiana di Fitosociologia. 5 maggio 1984. *Not. Fitosoc.* 19 (2): 147-163.
- Maarel Van der E., 1979. Transformation of cover-abundance values in phytosociology and its effect on community similarity. *Vegetatio* 39: 97-114.
- Magini E., 1955. Pinete di Pino d'Aleppo. *Atti del Congresso Nazionale di Selvicoltura*. Accademia Italiana di Scienze Forestali, Firenze.
- Mossa L., 1990. La vegetazione forestale del campo dunale di Buggerru-Portixeddu (Sardegna occidentale). *Ann. di Bot. (Roma)*. Studi sul territorio 48 (Suppl. 7): 291-306.
- Nyman C. F., 1879-1882. *Conspectus florae europaeae*. Örebro Sueciae.
- Oersted A. S., 1871-1872. Etudes préliminaires sur les Cupulifères de l'époque actuelle, principalement au point de vue de leurs rapports avec les espèces fossiles. *Vidensk. Sebk. Skrift.* 5 Raekke, naturvidensk. og matem., Afd. 9, 6: 331-358.
- Pedrotti F. & Venanzoni R., 1994. Carta della vegetazione del bosco dell'Incoronata (Foggia). S.E.L.C.A. Firenze.
- Poech I., 1842. *Dissertatio inauguralis Botanica sistens enumerationem plantarum hucusque cognitarum insulae Cypri*. Vindobonae.
- Rikli M., 1943-48. *Das Pflanzenkleid der Mittelmeerlande*. Bern.
- Rivas-Martinez S., Penas A. & Diaz T. E., 2001. Biogeographic map of Europe. Cartographic Service, University of León, Spain.
- Sabato S., 1972. Considerazioni sul significato fitogeografico ed ecologico di "*Quercus coccifera*" L. s.l. nel Salento (Puglia). *Webbia* 27 (2): 517-549.
- Scarascia Mugnozza G. & Schirone B., 1983. Un bosco di sughera presso Brindisi. Monti e Boschi, anno XXXIV, 6 novembre-dicembre: 47-52.
- Schwarz O., 1936-1937. *Monographie der Eichen Europas und der Mittelmeergebietes*. Fedde's Rep., Sonderbeiheft D: 1-5.
- Tormen L., 1953. Segnalazione di alcuni boschi di *Quercus suber* L. in provincia di Brindisi. *Nuovo Giorn. Bot. Ital.* 60: 900-903.
- Trinajstić I., 1987. Sintaksonomiski pregled biljnih zajednica planine Biokovo. *Acta Biokovica* IV: 143-174.
- Tutin T.G., Burges N.A., Chater A.O., Edmonson J.R., Heywood V.H., Moore D.M., Valentine D.H., Walters S.M. & Webb D.A., 1993. *Flora Europaea*, 1. Cambridge University Press.
- Vita F. & Leone V., 1980. Presenza di *Quercus suber* L. nel bosco "Lama Coppa" nel territorio di Ostuni (Brindisi). *Cellula e Carta* 10: 47-57.
- Westoff, V. & Maarel Van Der, E., 1978. The Braun-Blanquet approach: 2nd ed. In R.H. Whittaker (ed.), *Classification of Plant Community*. Junk, The Hague.
- Zohary M., 1961. On the Oak species of the Middle east. *Bull. Res. Council Israel, Sect. D., Botany*, 9 D, 4: 161-186.

Appendix

Tab. 1 - *Thymo capitati-Pinetum halepensis* ; *Cyclamino hederifolii-Pinetum halepensis*

Accidental species:

rel. 1: *Leopoldia comosa* (L.) Parl. +, *Elaeoselinum asclepium* (L.) Bertol. +; rel. 2: *Crupina crupinastrum* (Moris) Vis. +2, *Dianthus sylvestris* Wulfen ssp. *garganicus* (Grande) Pign.

+2, *Stipa austroitalica* Martinovsky +2, *Poa bulbosa* L. +, *Micromeria canescens* (Guss.) Bentham +, *Allium sphaerocephalon* L. +, *Petrorhagia saxifraga* (L.) Link +; rel. 3: *Pyrus amygdaliformis* Vill. +, *Pallenis spinosa* (L.) Cass. +2, *Crupina crupinastrum* (Moris) Vis. +, *Dactylis hispanica* Roth +, *Stipa capensis* Thunb. +, *Scabiosa maritima* L. +; rel. 4: *Leopoldia comosa* (L.) Parl. +, *Sonchus tenerrimus* L. +; rel. 5: *Salvia pratensis* L. ssp. *haematodes* (L.) Briq. +; rel. 6: *Rubus ulmifolius* Schott 1.2, *Acanthus mollis* L. 1.1, *Mercurialis annua* L. +, *Hedera helix* L. 1.2, *Daucus broteri* Ten. +, *Brachypodium sylvaticum* (Hudson) Beauv. +2, *Buglossoides purpureoacerulea* (L.) Johnston +2, *Prunus spinosa* L. 1.2; rel. 7: *Acanthus mollis* L. 2.2, *Silene italica* (L.) Pers. +2, *Sonchus asper* (L.) Hill +, *Dactylis hispanica* Roth +, *Paliurus spina christi* Miller +, *Ranunculus bulbosus* L. +, *Aristolochia longa* L. +, *Campanula rapunculus* L. +, *Vicia cracca* L. +; rel. 8: *Sedum rupestre* L. +, *Teucrium chamaedrys* L. +2, *Sonchus asper* (L.) Hill +, *Sanguisorba minor* Scop. +; rel. 9: *Mercurialis annua* L. +, *Parietaria lusitanica* L. +, *Tamus communis* L. +, *Orobanche hederæ* Duby +, *Salvia triloba* L. fil. +; rel. 10: *Sedum rupestre* L. +2, *Pyrus amygdaliformis* Vill. +, *Silene italica* (L.) Pers. +, *Convolvulus cantabrica* L. +; rel. 11: *Rubus ulmifolius* Schott +, *Teucrium chamaedrys* L. +2, *Pallenis spinosa* (L.) Cass. (+), *Convolvulus cantabrica* L. +, *Hypericum perforatum* L. +.

Locality and date of the relevés:

rel. 1: Gravina di Leucaspide (29.05.2003); rel. 2: Gravina di Leucaspide (11.06.2003); rel. 3: Gravina del Triglio (09.06.1997); rel. 4: Gravina di Leucaspide (29.05.2003); rel. 5: Gravina di L'Amastuola (4.05.2002); rel. 6: Gravina di Leucaspide (18.06.2002); rel. 7: Gravina del Triglio (04.05.1997); rel. 8: Gravina del Triglio (15.05.1997); rel. 9: Gravina di Leucaspide (25.05.2001); rel. 10: Gravina del Triglio (02.06.1997); rel. 11: Gravina del Triglio (26.05.1997); rel. 12: Gravina di Leucaspide (25.05.2001).

Tab. 2 - *Carici halleranae-Quercetum suberis*

Accidental species:

rel. 1: *Dorycnium pentaphyllum* Scop. ssp. *suffruticosum* (Vill.) Rouy +2; rel. 2: *Ligustrum vulgare* L. +2; rel. 6: *Silene italica* (L.) Pers. 1.2, *Scilla autumnalis* L. +, *Cynosurus cristatus* L. +, *Cistus monspeliensis* L. 1.2.

Locality and date of the relevés:

rel. 1: Tutturano, "Bosco di S. Teresa" (02.09.2003); rel. 2: Mesagne, "Bosco Preti" (06.09.2003); rel. 3: Mesagne, "Bosco Preti" (06.09.2003); rel. 4: Tutturano, "Bosco di S. Teresa" (02.09.2003); rel. 5: Mesagne, "Bosco I Lucci" (06.09.2003); rel. 6: Mesagne, "Bosco I Lucci" (06.09.2003).

Tab. 3 - *Arbuto-Quercetum calliprini; Hedero heliicis-Quercetum calliprini*

Accidental species:

rel. 1: *Pulicaria odora* (L.) Rehb. +; rel. 5: *Arum italicum* Miller +; rel. 7: *Allium amethystinum* Tausch +; rel. 8: *Cistus salvifolius* L. +; rel. 9: *Oryzopsis miliacea* (L.) Asch et Schweinf. +, *Phlomis fruticosa* L. +; rel. 11: *Dactylis glomerata* L. +, *Cistus monspeliensis* L. +, *Micromeria graeca* (L.) Bentham +; rel. 13: *Clinopodium vulgare* L. +2, *Anthoxanthum odoratum* L. +, *Brachypodium rupestre* (Host) R. et S. +2, *Teucrium chamaedrys* L. +2, *Silene alba* (Miller) Krause +, *Crataegus monogyna* Jacq. +2, *Euonymus europaeus* L. +, *Prunus mahaleb* L. +, *Stachys officinalis* (L.) Trevisan +2, *Quercus cerris* L. 1.2, *Quercus pubescens* Willd. 1.2; rel. 14: *Melica arrecta* O. Kuntze +, *Tamus communis* L. 1.2.

Locality and date of the relevés:

rel. 1-7: from Brullo *et al.*, 1986 (Tab. 3); rel. 8: Maglie, Fraganita wood (07.09.2001); rel. 9: Along the route Maglie-Gallipoli (07.09.2001); rel. 10: Ruffano, Madonna della Serra (21.08.2002); rel. 11: Polignano, "Lama di Macchia Longa" (29.08.2001); rel. 12: Supersano, Serra Natural Park (20.08.2002); rel. 13: Santeramo in Colle, La Parata wood (05.09.2003); rel. 14: Torre Guaceto (29.08.2001).

Tab. 4 - *Cyclamino hederifolii-Quercetum ilicis*

Accidental species and locality and date of the relevés:

see page 15.

Tab. 5 - *Festuco exaltatae-Quercetum ilicis*

Accidental species:

rel. 2: *Stipa bromoides* (L.) Doerfl. +, *Sorbus domestica* L. (+), *Cistus monspeliensis* L. +, *Teucrium siculum* Rafin. +2, *Oryzopsis miliacea* (L.) Asch et Schweinf. +, *Sorbus torminalis* (L.) Crantz 1.2, *Carex divulsa* Stokes +; rel. 3: *Cornus mas* L. 1.2, *Parietaria diffusa* M. et K. 1.2, *Rosmarinus officinalis* L. 1.2; rel. 4: *Rubus canescens* DC. +; rel. 5: *Geranium lucidum* L. +, *Geum urbanum* L. +, *Arum italicum* Miller +, *Colutea arborescens* L. +, *Cephalanthera damasonium* (Miller) Druce +; rel. 6: *Ranunculus bulbosus* L. +, *Carex depauperata* Good. +, *Crepis vesicaria* L. +, *Silene viridiflora* L. +, *Stellaria media* (L.) Vill. +; rel. 8: *Geranium lucidum* L. +, *Geranium sanguineum* L. +, *Luzula forsteri* (Sm.) DC. +, *Vicia bithynica* (L.) L. +; rel. 11: *Acer monspessulanum* L. +, *Osyris alba* L. +2, *Cornus mas* L. +, *Acer campestre* L. 1.1, *Clematis vitalba* L. +, *Buglossoides purpureoacerulea* (L.) Johnston 1.2, *Ficus carica* L. 1.1, *Lathyrus sylvestris* L. +; rel. 12: *Acer monspessulanum* L. 1.1, *Osyris alba* L. +, *Acanthus mollis* L. +2, *Arabis hirsuta* (L.) Scop. +2.

Locality and date of the relevés:

rel. 1: Martina Franca, "Bosco delle Pianelle" Lama "Piovacqua", in a little valley (20.06.2000); rel. 2: Caritate,

“Valle del Tesoro” (Gargano) (13.07.2003); rel. 3: Gravina di Alezza (16.05.2002); rel. 4: Martina Franca, “Bosco delle Pianelle”, in a deep valley (28.08.2001); rel. 5: Martina Franca, “Bosco delle Pianelle”, at the bottom of a hillside (26.04.2000); rel. 6: Martina Franca, “Bosco delle Pianelle” (02.06.1999); rel. 7: Martina Franca, “Bosco delle Pianelle”, at the bottom of a hillside (30.05.2000); rel. 8: Martina Franca, “Bosco delle Pianelle”, in a deep valley (10.05.2000); rel. 9: Martina Franca, “Bosco delle Pianelle”, at the bottom of a hillside (23.06.2000); rel. 10: Martina Franca, “Bosco delle Pianelle” (23.06.2000); rel. 11: Gravina di Laterza, Selva San Vito next to Sant’Angela bridge (20.07.2003); rel. 12: Laterza, “fosso dell’Alloro”, on the bottom of the stream (08.08.2003); rel. 13: Martina Franca, “Bosco delle Pianelle” (30.05.2000).

Tab. 6 - *Teucrio siculi-Quercetum trojanae*

Accidental species:

rel. 1: *Melica transsylvanica* Schur +, *Hypochoeris achyrophorus* L. +; rel. 2: *Cistus creticus* L. ssp. *creticus* +, *Allium tenuiflorum* Ten. +; rel. 3: *Polypodium vulgare* L. 1.2, *Asplenium trichomanes* L. +; rel. 4: *Polypodium vulgare* L. +, *Asplenium trichomanes* L. +, *Umbilicus rupestris* (Salisb.) Dandy +; rel. 5: *Umbilicus rupestris* (Salisb.) Dandy +; rel. 6: *Ranunculus bulbosus* L. +, *Anemone hortensis* L. +, *Avena barbata* Potter +, *Dasypyrum villosum* (L.) Borbas +, *Trifolium campestre* Schreber +, *Trifolium stellatum* L. +; rel. 7: *Trifolium angustifolium* L. +.2, *Cynosurus echinatus* L. +, *Reichardia picroides* (L.) Roth +; rel. 8: *Psoralea bituminosa* L. (+); rel. 9: *Ranunculus neapolitanus* Ten. +, *Leopoldia comosa* (L.) Parl. +; rel. 10: *Ranunculus bulbosus* L. 1.2, *Thapsia garganica* L. +.2, *Trifolium angustifolium* L. +.2, *Eryngium campestre* L. +, *Plantago lanceolata* L. 1.2, *Sedum rupestre* L. +.2, *Sonchus asper* (L.) Hill +; rel. 11: *Bupleurum falcatum* L. 1.1; rel. 12: *Anemone hortensis* L. +, *Thapsia garganica* L. +, *Galium verum* L. 1.2, *Clinopodium vulgare* L. +; rel. 13: *Chamaecytisus spinescens* (Presl) Rothm. 1.2, *Hypericum montanum* L. +, *Centaurea apula* Bianco & Brullo +.

Locality and date of the relevés:

rel. 1: Gravina di Laterza (23.06.2002); rel. 2: Gravina di Laterza, “Selva San Vito” (23.06.2002); rel. 3: Gravina di Laterza, next to Scivolizzo pinewood (24.06.2001); rel. 4: Gravina di Laterza, next to Scivolizzo pinewood (09.06.2001); rel. 5: Gravina di Laterza, next to Scivolizzo pinewood (28.08.2001); rel. 6: Gravina di Laterza (08.06.2001); rel. 7: Gravina di Laterza, “Selva San Vito”, next to Scivolizzo pinewood (05.06.2002); rel. 8: Gravina di Laterza, Lamia Scaravace (09.06.2001); rel. 9: Gravina di Laterza, “Selva San Vito”, next to Scivolizzo pinewood (24.05.2002); rel. 10: Gravina di Laterza, “Selva San Vito”, next to Scivolizzo pinewood (15.06.2002); rel. 11: Gravina di Laterza, “Selva San Vito”, next to Scivolizzo pinewood (28.08.2001); rel. 12:

Gravina di Laterza, “Selva San Vito”, next to Scivolizzo pinewood (22.06.2002); rel. 13: Gravina di Laterza (06.05.2001).

Tab. 7 - *Irido collinae-Quercetum virgiliana*

Accidental species:

rel. 3: *Agrimonia eupatoria* L. +, *Prunella vulgaris* L. +.2, *Rumex conglomeratus* Murray +, *Arundo pliniana* Turra +; rel. 4: *Orobanche hederæ* Duby 1.2, *Bellevalia ciliata* (Cyr.) Nees +.

Locality and date of the relevés:

rel. 1: “Bosco dell’Incoronata” (Foggia) (04.09.2003); rel. 2: “Bosco dell’Incoronata” (Foggia) (04.09.2003); rel. 3: “Bosco dell’Incoronata” (Foggia) (04.09.2003); rel. 4: “Bosco dell’Incoronata” (Foggia) (04.09.2003).

Tab. 8 - *Cyclamino hederifolii-Quercetum virgiliana*

Accidental species:

rel. 1: *Bellis sylvestris* Cyr. +, *Geranium purpureum* Vill. +, *Melica arrecta* O. Kuntze 1.2, *Silene latifolia* Poir. +, *Galium aparine* L. +, *Potentilla detommasii* Ten. +; rel. 2: *Lathyrus aphaca* L. +, *Anemone hortensis* L. +, *Serratula cichoracea* (L.) DC. ssp. *cichoracea* 1.1, *Ornithogalum gussonei* Ten. 1.1, *Vicia bithynica* (L.) L. +, *Silene vulgaris* (Moench) Garcke +, *Helianthemum salicifolium* (L.) Miller +, *Centaurea triumfetti* All. 1.1; rel. 3: *Galium aristatum* L. 1.3, *Astragalus glycyphyllos* L. +.2; rel. 4: *Selaginella denticulata* (L.) Link +.2; rel. 5: *Prunella vulgaris* L. +.2; rel. 6: *Oryzopsis miliacea* (L.) Asch et Schweinf. +.2.

Locality and date of the relevés:

rel. 1: Volturino, “Bosco Marano” (14.05.2003); rel. 2: Volturino, “Bosco Marano” (14.05.2003); rel. 3: Gargano, Malatecco (13.07.2003); rel. 4: going up to Sannicandro from Apricena (07.09.2003); rel. 5: going up to Sannicandro from Apricena (07.09.2003); rel. 6: along the route Manfredonia-Monte S. Angelo, near Masseria Castellara (28.08.2003).

Tab. 9 - *Stipo bromoidis-Quercetum dalechampii*

Accidental species:

rel. 1: *Quercus calliprinos* Webb 1.2, *Carex distachya* Desf. 1.2, *Dactylis glomerata* L. +.2, *Centaurea deusta* Ten. ssp. *divaricata* (Guss.) Matthes et Pign. +, *Orobanche crenata* Forsskal +, *Anthoxanthum odoratum* L. 1.1; rel. 3: *Dactylis hispanica* Roth +, *Melica ciliata* L. 1.1; rel. 4: *Prunella vulgaris* L. +, *Brachypodium rupestre* (Host) R. et S. +.2.

Locality and date of the relevés:

rel. 1: Cassano Murge, “Bosco Quasano” (05.09.2003); rel. 2: Cassano Murge, “Bosco Quasano” (05.09.2003); rel. 3: Cassano Murge, “Bosco Quasano” (05.09.2003); rel. 4: Cassano Murge, “Bosco Sentinella” (05.09.2003); rel. 5: Cassano Murge, “Bosco Sentinella” (05.09.2003).