SYNTAXONOMICAL ANALYSIS OF THE BEECH FORESTS FROM SICILY

S. Brullo*, R. Guarino*, P. Minissale*, G. Siracusa*, G. Spampinato**
** Dipartimento di Botanica, Via A. Longo, 19 - I - 95125 Catania, Italy*
***Dipartimento S.T.A.F.A., P.zza San Francesco 4, I-89061 Gallina (RC) - Italy*

Abstract – The results of a phytosociological investigation on the beech forests occurring in Sicily are given. On the basis of literature and unpublished data, four well differentiated associations have been identified and classified within the *Doronico-Fagion*, alliance of *Querco-Fagetea*. All the surveyed woodlands are localized in the mountain belt of North and North-Eastern Sicily. The associations have been examined from the floristical, ecological, chorological and nomenclatural point of view. Besides, a numerical analysis applied to the phytosociological relevés emphasizes the differences among the associations.

Key words - Beech forests, Sicily, Syntaxonomy.

Introduction

Beech forests have in Sicily one of the southernmost places of their distribution area. Here they are localized in the northern mountain range at an altitude of 1400-1800 m, but sometimes, in fresh and shady conditions, such as valleys and north-facing slopes, it is possible to find beech forests even at 1000 m of altitude.

Phytosociological investigations on the Sicilian beech-woods were carried out by various authors who emphasized a certain peculiarity of these communities, if compared with those occurring in other European countries. The first data on the Sicilian beech forests are reported by Pirola & Vecchio (1960), who included the communities from Etna in the *Fagion sylvaticae* and by Hofmann (1960) who attributed the Sicilian communities to a provisory association, named *Anthrisco siculae-Fagetum*. Later, Gentile (1969) included the beech forests from Sicily and S Italy in the new association *Aquifolio-Fagetum*, belonging to the alliance *Geranio-Fagion*. Afterwards, Ronsisvalle & Signorello (1977) and Poli *et al*. (1979a, 1979b, 1981) referred the beech forests occurring on Peloritani mountains and Etna respectively, to the *Aquifolio-Fagetum*; while, for what concerns the calcicolous communities from Madonie, Raimondo (1980) quoted a *Fagetum s.l.* Then Brullo (1984) emphasized that *Aquifolio-Fagetum* is an illegitimate name (art 31, 32) and proposed the new name *Anemono apenninae-Fagetum* instead of the former one, and finally Ubaldi (1995),

basing on the relevés published by Ronsisvalle & Signorello (l.c.), described the new association *Melitto albidae-Fagetum*.

In our attempt to clarify the syntaxonomical problems of the Sicilian beech forests, a careful study, based both on literature and on field investigations, has been carried out.

Material and methods

For the syntaxonomical analysis, a set of 126 relevés (64 personal unpublished and 62 from literature) of Sicilian beech forests has been considered. In order to value the vegetational similarity among the available material, a pilot analysis based on a selection of 36 relevés (tab. 1), partly choosen from literature, was performed by means of multivariate analysis by using the package Sintax 5.0 (Podani, 1993). The selection of the processed relevés has been made by valuating the characteristic species composition of the personal relevés and by adding to the set some relevés coming from literature when their number of species was equal or higher than the determined characteristic species composition. Finally, within the selection, only one representative relevé has been considered among those having more than the 85% of species in common. The significance of the relevés was decided also by evaluating the ratio between the number of species of each sample and that of the higher syntaxa characteristic species recorded in the same. The lowest values of the ratio have been obviously preferred. To produce the dissimilarity matrixes from the 36 relevés x 82 species matrix, the Euclidean squared distance, the chord distance, the Sørensen's and the Jaccard's algorithms have been adopted. On that basis, sixteen classification dendrograms have been produced by utilizing respectively the single, average and complete linkage as agglomeration criterion,. In order to operate a selection among the clustering results, the consensus partition theory was adopted. From the evaluation of the differences among the clustering levels, four associations have been recognized within the former matrix. This is in accordance with the results of the standardized principal component analysis, based on the correlation between variables derived from the same data set.

Every numerical performance is based on presence/absence (binary) data. The nomenclature of the species follows Pignatti (1982). The bioclimatic classification follows Rivas-Martínez (see Brullo *et al*. 1996).

Results

As aforesaid, the numerical analysis allows to recognize, within the Sicilian beech-woods, five main types. In Fig.1 a classification dendrogram produced by using the average linkage criterion on a dissimilarity matrix obtained from the application of the chord distance algorithm is reported, which better shows the groups of relevés, among the other dendrograms obtained with the above-mentioned dissimilarity algorithms.

The same result is achieved by the principal components analysis, where the scatter diagram according to the first two axes (fig. 2), shows 3 well separated groups, corresponding to the beech forests of Etna and Madonie and 2 other contiguous groups, corresponding to the Nebrodi and Peloritani beech forests, whose residual variance is however well expressed by the first/third axes scatter diagram (fig. 3). The first axis

TABLE 1

Nr. of the species	Number of the relevé	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
	Altitude (dam)	160	160	160	155	160	152	125	140	128	140	101	113	122	115	110	130	129	126	127	125	160	162	170	168	167	165	160	160	160	160	160	155	157	120	130	135
	Surface (m^2)	100	100	100	100	100	100	400	400	400	400	150	200	50	150	200	150	100	150	100	100	100	100	100	150	100	150	100	100	200	100	100	100	100	100	100	100
	Coverage (%)	100	100	100	100	100	100	100	85	80	80	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1	Ilex aquifolium	3	2	3	2	3	1	4	2	2	2	2	.	.	+	+	.	.	+	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	Ranunculus umbrosus	.	+	.	.	.	.	.	+	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3	Allium ursinum	.	+	.	.	.	.	.	.	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4	Anthriscus nemorosa	.	+	.	.	.	+	.	2	1	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
13	Melittis albida	.	.	.	.	.	.	.	.	+	.	+	+	1	1	1	+	+	1	2	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
15	Polygonatum multiflorum	.	.	.	.	.	.	.	+	.	.	1	3	.	+	+	.	1	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
14	Saxifraga rotundifolia	.	.	.	.	.	.	.	.	.	.	+	.	3	1	+	1	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
38	Acer obtusatum var. obtusatum	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	2	1	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16	Symphytum gussonei	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
17	Limodorum abortivum	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	+	+	+	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
11	Cephalanthera damasonium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.
12	Cephalanthera rubra	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	+	1	+	+	.	.	.	.	.	.	.	.	.	.	.
5	Cephalanthera maravignae	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	1	.	.	.	.	.	.	.
6	Epipactis meridionalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	1	.	2	.	.	.	.	.	.
38	Acer obtusatum var. aetnense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	+	2	1	1	.
7	Rubus aetnicus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	3	1	1	.
73	Vicia cassubica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	+	+	+	.
9	Pinus nigra ssp. calabrica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	1	.
10	Agropyron panormitanum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.
	Char. *Doronico-Fagion*																																					
20	Lathyrus venetus	1	.	2	2	3	.	.	+	1	+	1	2	2	1	2	2	2	2	2	2	.	.	.	2	+	.	.	.	.	.	+	1	+	1	+	+
23	Euphorbia amygdaloides ssp. arbuscula	.	1	2	+	1	.	1	+	+	.	+	1	+	1	1	+	1	1	2	1	+	+	+	+	2	+	.	.	.	.	.	.	.	.	.	.	.
50	Allium pendulinum	+	+	+	+	.	.	.	.	+	1	2	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
26	Lamium flexuosum	1	+	+	.	1	1	.	1	1	+	+	+	1	1	1	.	.	+	1	+	3	1	1	+	1	+	.	.	.	.	.	.	.	.	.	.	.
28	Doronicum orientale	2	2	.	.	.	.	.	1	.	2	1	1	1	.	.	.	+	+	+	+	1	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.
30	Anemone apennina	.	1	2	1	1	.	.	1	1	+	3	2	+	+	.	.	.	.	.	.	1	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.
35	Luzula sicula	1	+	.	.	.	1	.	.	+	1	1	1	2	1	1	.	.	.	.	.	2	3	1	3	2	3	.	.	.	.	.	.	.	.	.	.	.
76	Arum cylindraceum	.	+	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
72	Ranunculus lanuginosus	.	.	+	+	.	.	.	.	+	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
53	Festuca exaltata	.	.	.	.	1	1	.	+	.	3	.	1	.	2	.	.	1	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Char. *Fagetalia and Querco-Fagetea*																																					
18	Fagus sylvatica	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	4	5	5	5	5	5	5	5	5	5	5	5	4	5	4	5	4	5
19	Viola reichenbachiana	+	+	.	.	1	.	1	+	+	1	1	.	1	+	1	.	.	.	.	+	1	+	+	+	+	+	1	+	+	.	.	+	1	1	1	+
21	Rubus hirtus	.	2	.	1	2	1	1	1	1	+	2	1	1	2	1	+	2	1	2	.	1	1	.	1	1	.	+	.	+	1	+	.	.	.	.	.
22	Festuca heterophylla	2	2	.	.	.	.	.	.	.	.	.	1	2	1	.	1	1	1	.	.	2	1	1	3	2	2	+	+	+	2	1	3	3	2	1	1
25	Melica uniflora	+	+	+	1	.	.	+	+	.	.	1	2	1	1	1	1	+	1	1	+	+	+	+	+	+	1	.	.	.	.	.	.	.	.	.	.	.
27	Brachypodium sylvaticum	2	2	2	1	1	.	+	.	.	.	.	.	.	.	.	.	.	1	2	1	.	.	.	.	2	1	2	1	+	1	.	+	1	1	+	1	1
28	Daphne laureola	.	1	1	1	+	+	1	+	1	+	+	1	1	+	1	2	2	2	2	1	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
29	Hedera helix	1	1	2	2	1	.	+	+	+	.	1	1	+	1	1	1	1	2	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
33	Sanicula europaea	.	+	1	1	+	.	1	1	1	.	1	2	+	+	+	2	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
31	Aremonia agrimonioides	.	+	+	+	+	.	.	+	.	.	1	1	2	+	+	.	.	+	1	+	.	.	.	+	+	.	+	.	+	.	.	.	.	.	.	.	.
36	Neottia nidus-avis	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	+	.	+	+	+	+	+	+	+	+	+	.	.	.	.	.	.	.	.	.
39	Galium rotundifolium	+	.	1	1	+	.	.	.	.	.	.	1	+	1	.	.	.	.	.	.	3	1	2	1	1	1	.	.	.	.	.	.	.	.	.	.	.
42	Quercus cerris (transgr.)	.	1	1	1	.	2	.	.	.	.	+	+	.	.	.	2	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	1	1	1	1
40	Polystichum setiferum	.	.	.	1	1	.	+	.	2	.	.	.	1	1	+	+	+	1	2	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
44	Mycelis muralis	+	1	1	1	1	.	.	+	.	.	.	+	+	.	.	.	+	1	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
41	Geranium robertianum	+	.	+	.	.	.	+	+	1	+	.	.	+	.	+	1	+	.	2	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
45	Epipactis microphylla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	+	+	+	+	+	.	.	+	.	.	.	.	.	.	.	.
49	Conopodium capillifolium (transgr.)	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	1	+	.	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.
54	Primula vulgaris	2	1	.	1	.	1	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.
56	Geum urbanum	+	+	.	.	+	.	.	.	.	.	.	1	+	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
57	Epipactis helleborine	.	.	.	.	.	.	.	.	.	.	.	+	+	+	1	1	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
58	Poa sylvicola	.	.	.	+	+	+	.	.	1	.	.	.	.	.	.	1	1	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
60	Acer campestre (transgr.)	1	.	1	1	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.
61	Acer pseudoplatanus (transgr.)	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	.	1	1	.	.	.	.	1	1	1	.	.	.	.	.	.	.	.	.	.	.
65	Milium effusum	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	1	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
66	Rosa canina	.	.	+	.	.	+	1	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.
68	Aquilegia vulgaris	.	.	.	.	.	.	.	+	+	.	.	+	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
71	Monotropa hypopithys	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.
8	Quercus dalechampii (transgr.)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	1	1	.
74	Lathyrus pratensis	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	1	.	~	.	.
79	Malus sylvestris (transgr.)	1	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
81	Scilla bifolia	.	1	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
78	Clematis vitalba	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
82	Symphytum tuberosum (transgr.)	.	.	.	.	.	.	.	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
80	Sambucus nigra	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Other species																																				
24	Pteridium aquilinum	2	+	+	1	.	+	.	.	.	.	1	1	+	.	1	1	+	1	.	+	.	.	.	.	.	.	2	2	+	1	1	+	1	1	+	1
37	Silene sicula	+	1	.	.	1	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	+	2	1	1	.	.	.	.	+	3	+	1	.	+	+
63	Cyclamen hederifolium	.	.	.	.	.	1	1	+	+	.	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
64	Cyclamen repandum	.	.	.	.	.	.	.	+	2	1	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
69	Crataegus monogyna	.	+	+	1	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
43	Hypochoeris laevigata	.	.	.	1	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	+	2	2	2	.	.	.	+	.	.	.	+	.	+	+
46	Fragaria vesca	.	.	.	.	+	.	.	+	+	+	+	.	+	+	1	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.
47	Trifolium semipurpureum	.	+	.	.	.	.	.	.	+	.	.	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	+	1	1	+	.	+	.	.	.
48	Paeonia mascula ssp. russii	.	.	.	.	.	.	.	.	.	.	+	1	1	.	.	+	+	1	1	1	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.
52	Dactylis glomerata	+	+	.	1	.	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	+	1	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.
55	Tamus communis	+	+	.	.	.	.	.	.	.	.	1	.	.	.	+	+	+	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
67	Viola alba ssp. dehnhardtii	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
51	Crepis leontodontoides	.	.	.	+	.	+	.	.	.	.	.	.	+	.	.	.	.	.	+	.	+	+	.	+	.	+	.	.	.	.	+	.	.	.	.	.	.
59	Ruscus aculeatus	.	1	.	.	.	.	.	+	+	+	2	.	.	+	+	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
62	Chaerophyllum temulum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	1	1	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
70	Luzula forsteri	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	1	+	.	.	.	.	.
75	Silene vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	1	.	+	+	.	.	.	.	.	.	.	.	.	.	.
77	Bellis perennis	.	.	.	.	.	.	.	+	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Rel. 1: Serra del Re (Nebrodi), 26-6-1990.
Rel. 2: Portella dell'Obolo (Nebrodi), 5-7-1983.
Rel. 3-5: Monte Soro (Nebrodi), 25-10-1987.
Rel. 6-7: Gentile (1969), Tab. 3, rel. 7, 9.
Rel. 8-10: Hofmann (1960), Tab. 2: rel. 1, 3, 7.

Rel. 11-15: Ronsisvalle & Signorello (1977): Tab. 1, rel. 5, 6, 12, 14, 19.
Rel 18-20: Malabotta (Peloritani), 16-7-1996.
Rel. 21-22: Piano della Battaglia (Madonie), 19-7-1996.
Rel. 23: Monte Mufara (Madonie), 19-7-1996.
Rel. 24-26: Quacella (Madonie), 19-7-1996.

Rel. 27-29: Monte Spagnolo (Etna), 26-7-1994.
Rel. 30: Vallone del Tripodio (Etna), 29-7-1994.
Rel. 31: Dammusi (Etna), 26-7-1994.
Rel 32-33: Giarrita (Etna), 11-7-1996.
Rel. 34-36: Giarrita (Etna) 2-11-1996.

TABLE 2

Number of association	1	2	3	4	5	6	7	8	9	10	11	12
Number of relevés	13	10	7	7	22	7	6	4	36	8	4	2
Char. Association												
Ilex aquifolium	54	60	100	85	63	40	.	.	6	.	.	.
Anthriscus nemorosa	85	20	10	.	40	.	.	50	.	.	.	.
Allium ursinum	69	10	10	.	.	.	.	.	.	.	.	.
Ranunculus umbrosus	85	.	10	43	.	.	.	25	.	.	.	.
Melittis albida	23	.	.	.	73	70	.	.	.	.	.	.
Saxifraga rotundifolia	.	.	.	.	49	70	.	.	.	.	.	.
Polygonatum multiflorum	15	.	.	.	40	90	.	.	.	.	.	.
Symphytum gussonei	.	.	.	.	45	70	.	.	.	.	.	.
Limodorum abortivum	.	.	.	.	18	70	17	.	.	.	.	.
Acer obtusatum var. obtusatum	.	.	.	.	27	60	.	.	.	.	.	.
Cephalanthera rubra	.	.	.	.	.	.	100	50	.	.	.	.
Cephalanthera damasonium	.	.	.	.	.	.	100	.	.	.	.	.
Epipactis meridionalis	.	.	.	.	.	.	.	.	67	.	.	.
Cephalanthera maravignae	.	.	.	.	.	.	.	.	56	.	.	.
Acer obtusatum var. aetnense	.	.	.	.	.	.	.	.	8	75	75	.
Rubus aetnicus	.	.	.	.	.	.	.	.	20	100	.	.
Vicia cassubica	.	.	.	.	.	.	.	.	3	100	.	.
Pinus nigra ssp. calabrica	.	.	.	.	.	.	.	.	3	62	.	.
Agropyron panormitanum	.	.	.	.	.	.	.	.	.	50	.	.
Char. *Doronico-Fagion*												
2 Lathyrus venetus	46	20	90	43	100	100	33	.	22	100	100	.
3 Lamium flexuosum	92	80	90	85	67	40	100	100	.	.	50	.
3 Doronicum orientale	77	10	60	85	40	70	100	100	.	.	50	.
4 Anemone apennina	100	10	90	85	54	20	100	100	.	.	.	.
4 Euphorbia amygdaloides ssp. arbuscula	23	60	90	43	100	100	100	75	.	.	.	.
4 Luzula sicula	61	80	60	43	85	.	100	.	.	.	75	100
6 Geranium versicolor	38	70	100	14	94	100	.	.	.	.	.	.
7 Festuca exaltata	8	50	.	.	72	60	.	.	6	.	.	.
7 Allium pendulinum	92	50	60	43	45	.	.	.	.	.	.	.
9 Arum cylindraceum	.	.	40	.	14	10	.	.	.	.	.	.
10 Ranunculus lanuginosus	.	.	60	.	40	.	.	.	.	.	.	.
0												
0 Char. *Querco-Fagetea*												
0 Fagus sylvatica	100	100	100	100	100	100	100	100	100	100	100	100
1 Viola reichenbachiana	77	80	70	28	76	10	100	.	37	62	25	50
4 Brachypodium sylvaticum	.	40	100	.	18	60	33	.	70	87	75	.
4 Rubus hirtus	85	100	70	43	100	90	66	.	42	.	.	.
4 Daphne laureola	54	50	90	43	100	100	.	.	11	.	100	.
5 Aremonia agrimonioides	15	40	70	.	72	40	33	.	14	.	.	.
5 Neottia nidus-avis	15	30	60	.	.	90	100	25	48	.	.	.
5 Melica uniflora	38	60	90	14	67	100	100	.	.	.	.	.
5 Mycelis muralis	46	10	90	57	27	90	.	25	.	.	.	.
5 Polystichum setiferum	38	30	60	28	58	70	17	.	.	.	.	.
6 Festuca heterophylla	.	.	40	.	36	70	100	.	76	100	.	.
6 Galium rotundifolium	15	.	70	28	58	10	100	.	.	.	.	.
6 Geranium robertianum	77	20	10	.	36	60	.	.	.	.	50	.
6 Hedera helix	23	30	70	.	90	100	.	.	.	.	100	.
7 Acer campestre (transgr.)	8	40	40	.	18	.	33	.	.	.	.	.
7 Acer pseudoplatanus (transgr.)	31	50	.	.	.	3	50	75	.	.	.	.
7 Geum urbanum	.	20	60	.	18	30	.	.	.	12	.	.
7 Quercus cerris (transgr.)	.	20	40	.	27	30	.	.	.	100	.	.
7 Sanicula europaea	31	40	90	.	85	100	.	.	.	.	.	.
7 Corydalis solida	8	.	.	43	4	.	33	50	.	.	.	.
7 Lathyrus pratensis	.	.	10	.	13	.	.	.	53	75	.	.
7 Milium effusum	.	.	10	71	36	100	.	.	3	.	.	.
7 Hieracium lachenalii	.	.	.	.	9	.	33	.	14	37	.	100
8 Clematis vitalba	.	10	60	.	4	10	.	.	.	.	.	.
8 Monotropa hypopithys	.	.	.	.	9	10	66	25	.	.	.	.
8 Primula vulgaris	54	50	70	.	.	.	33	.	.	.	.	.
8 Scilla bifolia	15	.	70	28	.	.	.	100	.	.	.	.
9 Malus sylvestris (transgr.)	.	20	30	.	18	.	.	.	.	.	.	.
9 Conopodium capillifolium (transgr.)	.	.	.	.	22	70	50	.	.	.	.	.
9 Epipactis microphylla	.	.	.	.	.	90	100	.	3	.	.	.

9 Epipactis helleborine	.	.	.	43	40	100	.	.	.	.	.	.
9 Orthilia secunda	.	.	.	14	.	.	33	25	.	.	.	.
9 Quercus petraea (transgr.)	.	30	10	43	.	.	.	.	.	.	.	.
9 Veronica officinalis	.	.	30	43	.	.	.	.	3	.	.	.
9 Quercus dalechampii (transgr.)	.	.	.	.	18	.	.	.	.	62	25	.
9 Castanea sativa (transgr.)	.	.	.	.	.	.	.	.	3	.	100	50
10 Asperula odorata	85	80	.	.	.	.	.	.	.	.	.	.
10 Calamintha sylvatica	.	.	.	.	4	10	.	.	.	.	.	.
10 Potentilla micrantha	.	50	40	.	.	.	.	.	.	.	.	.
10 Symphytum tuberosum (transgr.)	54	20	.	.	.	.	.	.	.	.	.	.
10 Galium odoratum	.	.	.	57	.	.	.	50	.	.	.	.
11 Cardamine chelidonia	.	.	.	.	.	.	.	25	.	.	.	.
11 Platanthera bifolia	.	.	.	.	.	.	.	50	.	.	.	.
11 Dryopteris filix-mas	31	.	.	.	.	.	.	.	.	.	.	.
11 Lathraea squamaria	.	.	.	.	.	.	.	.	3	.	.	.
11 Moehringia trinervia	54	.	.	.	.	.	.	.	.	.	.	.
11 Taxus baccata	8	.	.	.	.	.	.	.	.	.	.	.
11 Veronica montana	.	.	.	.	9	.	.	.	.	.	.	.
0												
0 Other species												
3 Hypochoeris laevigata	.	50	30	57	.	.	100	75	22	25	50	100
4 Crepis leontodontoides	.	60	30	71	22	10	66	.	39	.	25	.
4 Trifolium semipurpureum	.	40	10	57	45	.	.	50	78	37	50	.
4 Silene sicula	.	.	40	14	.	.	83	25	45	75	50	100
5 Bellis perennis	77	60	10	71	27	10	.	100	.	.	.	.
5 Pteridium aquilinum	.	20	.	28	67	90	.	.	87	87	50	.
6 Cyclamen hederifolium	69	80	30	.	63	.	.	100	.	.	50	.
6 Rosa canina	.	40	30	43	31	.	.	.	22	.	100	.
7 Poa sylvicola	15	30	30	.	.	90	.	.	3	.	.	.
7 Ruscus aculeatus	38	20	10	.	58	10	.	.	.	.	.	.
7 Festuca circummediterranea	.	.	.	57	.	.	.	50	62	50	.	100
7 Luzula forsteri	23	20	.	43	.	.	.	.	39	.	100	.
8 Dactylis glomerata	.	70	40	.	40	.	66	.	.	.	.	.
8 Fragaria vesca	54	.	10	.	81	.	.	.	28	.	.	.
8 Tamus communis	.	.	40	.	18	70	.	.	.	.	25	.
8 Clinopodium vulgare ssp. arundanum	.	.	.	28	40	.	.	.	20	.	75	.
9 Alliaria petiolata	.	.	.	.	18	3	.	50	.	.	.	.
9 Aquilegia vulgaris	23	.	.	.	4	30	.	.	.	.	.	.
9 Chaerophyllum temulum	.	.	.	.	22	90	17	.	.	.	.	.
9 Crataegus monogyna	.	30	40	.	13	.	.	.	.	.	.	.
9 Paeonia mascula ssp. russii	.	.	.	.	36	70	33	.	.	.	.	.
9 Lathyrus grandiflorus	.	.	.	.	27	.	.	.	.	25	50	.
9 Milium vernale	85	.	.	71	.	.	.	50	.	.	.	.
9 Viola alba ssp. dehnhardtii	.	.	10	.	.	100	.	.	.	.	100	.
10 Arabis caucasica	15	.	.	.	.	.	.	50	.	.	.	.
10 Euphorbia corallioides	.	20	10	.	.	.	.	.	.	.	.	.
10 Mercurialis perennis	15	20	.	.	.	.	.	.	.	.	.	.
10 Myosotis gussonei	38	.	10	.	.	.	.	.	.	.	.	.
10 Populus tremula	.	.	.	.	.	.	.	.	17	25	.	.
10 Scutellaria columnae	.	.	.	.	27	10	.	.	.	.	.	.
10 Rumex nebrodes	.	.	.	.	.	.	17	50	.	.	.	.
10 Sambucus nigra	.	.	.	.	18	40	.	.	.	.	.	.
11 Betula aetnensis	.	.	.	.	.	.	.	.	.	50	.	.
11 Adenocarpus bivonae	.	.	.	.	.	.	.	.	.	37	.	.

1 - Anemono-Fagetum, see Hofmann (1960), Tab. 2
2 - Anemono-Fagetum, see Gentile (1969), Tab. 3, ril. 1, 2, 4-9, 12, 13
3 - Anemono-Fagetum, unpublished data
4 - Anemono-Fagetum , see Brullo, 1984, Tab. 21
5 - Anemono-Fagetum melittetosum, see Ronsisvalle & Signorello (1977),Tab. 1
6 - Anemono-Fagetum melittetosum, unpublished data
7 - Luzulo siculae-Fagetum, unpublished data
8 - Luzulo siculae-Fagetum, see Raimondo (1980), Tab. 12
9 - Epipactido meridionalis-Fagetum, unpublished data
10 - Rubo aetnici-Fagetum, unpublished data
11 - Rubo aetnici-Fagetum, see. Poli *et al.* (1979a): Tab. 1
12 - Fagetum s.l., see Pirola & Vecchio (1960), Tab. 1, rel. 1-2

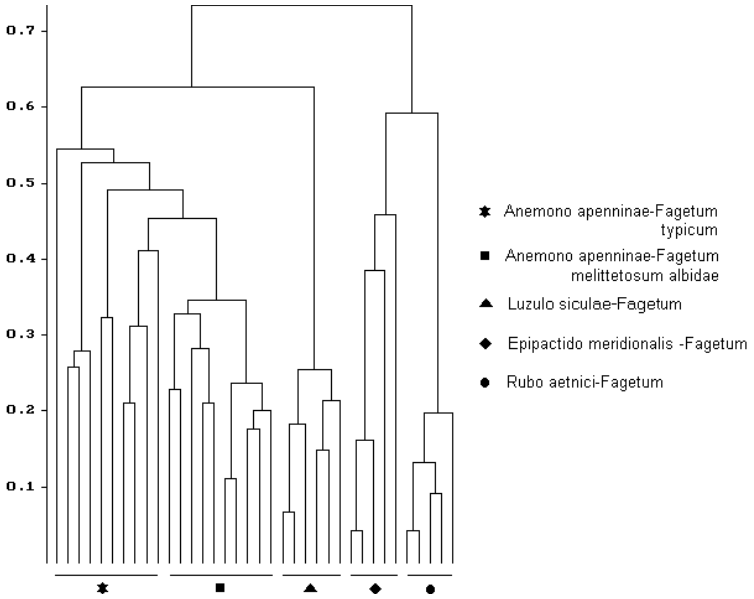

Fig. 1 – Classification dendrogram produced by using the average linkage criterion on a dissimilarity matrix obtained from the application of the chord distance algorithm.

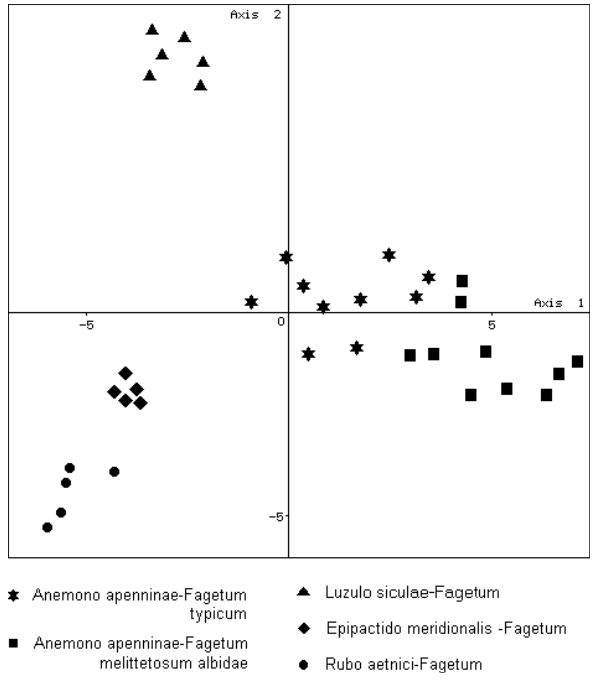

Fig. 2 – PCA scatter diagram according to the first/second axes.

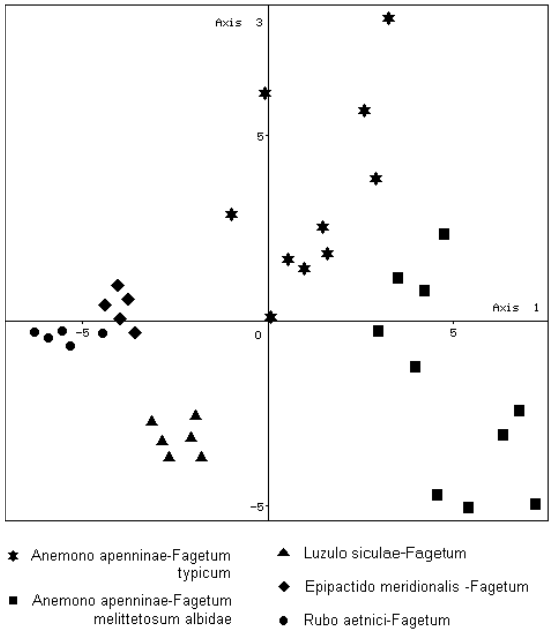

Fig. 3 – PCA scatter diagram according to the first/third axes.

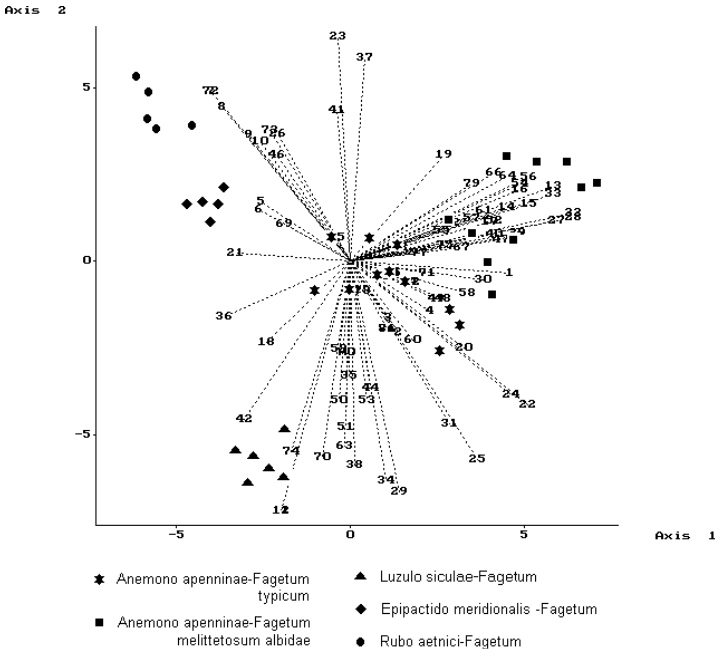

Fig. 4 – Biplot where the species are represented as eigenvectors superimposed onto the PCA diagram according to the first two axes (scale factor for variables: 29,08).

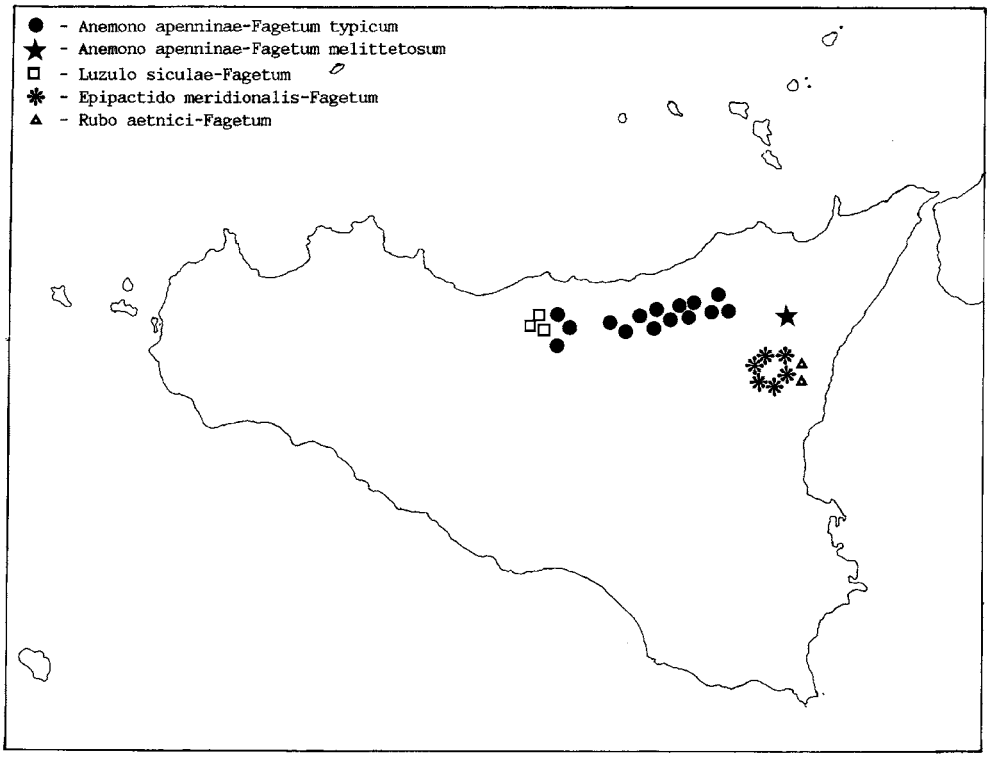

Fig. 5 – Map of the distribution of the surveyed associations in Sicily.

can be correlated to the edaphic aridity, which his maximized on the incoherent sandy volcanic soils, intermediate on the calcareous soils of Madonie massif and reaches its lowest values on the clayey-schistose soils of Nebrodi and Peloritani, with the minimum on the latter because of the hollowed situation. The second axis can be correlated to the nutrient concentration and pH of soils, which are highest within the basiphilous beech-woods of Madonie, intermediate in the slightly acidophilous forests of Nebrodi and Peloritani and lowest in the more acidophilous woods of Etna, particularly in those dwelling in the volcanic valleys, having more leachered soils. The third axis can be referred to the mesophily of the communities, which is lower for the communities occurring on Madonie and Peloritani mountains, compared to those of Etna and Nebrodi.

Each beech-wood type is well characterized by an own specific combination, as it is possible to see from the biplot in Fig. 4, where the species are represented as eigenvectors superimposed onto the PCA diagram. In Tab. 1, where the processed relevés are reported, the species are numbered according to the biplot.

As mentioned, in addition to the floristic differences, the five beech-wood types appear to be well differentiated also from the ecological point of view and have been classified as follows:

1. *Anemono apenninae-Fagetum* (Gentile, 1969) Brullo 1984, Boll. Acc. Gioenia

Sci. Nat. 16(322): 394 (Tab. 1, rel. 1-20; Tab. 2, ass. 1-5)

Syn.: *Anthrisco siculae-Fagetum* Hofmann 1960, Fl. Veg. Ital.2: 79, nom.inval. (art. 3b)

Aquifolio-Fagetum Gentile 1969, Atti Ist. Bot. Univ. Lab. Critt. Pavia, s. 6, 5: 222 nom. illeg. (art. 31, 32c)

Lectotype: rel. 9, Tab. 3, Gentile 1969.

DIFFERENTIAL SPECIES: *Ilex aquifolium, Ranunculus umbrosus, Allium ursinum, Anthriscus nemorosa*.

a. *typicum* (Tab. 1, rel. 1-10; Tab. 2, ass. 1-3)

ECOLOGY: Acidophilous beech forest linked to siliceous substrata, distributed in the mountain belt (1400-1800 m) characterized by a supramediterranean humid bioclimate. The presence of *Ilex aquifolium* emphasizes the remarkable oceanic character of this association, which is linked to a daily regimen of fogs due to the condensation of the humid streams coming from the Thyrrenian sea. This beech forest, for the aforesaid ecological requirement and the relevant physiognomical role played by the holly in the sapling stratum, is related to the *Ilici-Fagetum sylvaticae* Br.Bl. 1967 described from the Atlantic slope of the north-Iberian range. On schistose substrata, the *Anemono apenninae-Fagetum* comes into contact in the lower belt with the *Arrhenathero nebrodensis-Quercetum cerridis* Brullo et al. 1996, while the degradation processes bring to the meadows of the *Plantaginion cupanii* Brullo & Grillo 1978 (*Molinio-Arrhenatheretea* R. Tx. 1937). On quartziferous sandstones the contacts are with the *Teucrio siculi-Quercetum ilicis* Gentile 1969 em. Brullo, Di Martino & Marcenò 1977 (*Quercetea ilicis* Br.-Bl. ex A. Bolòs 1950) downwards and with the pulvinate orophilous communities of the *Armerion nebrodensis* Brullo 1984, alliance of *Cerastio-Carlinetea nebrodensis* Brullo 1984, upwards. In hollowed situations, characterized by a regular fog regime, the *Anemono apenninae-Fagetum* is substituted by the *Aquifolio-Quercetum petraeae* Brullo 1984.

DISTRIBUTION: This association occurs on Madonie and Nebrodi mountain range (N Sicily, Fig. 5) and in S Italy.

b. *melittetosum albidae* (Ubaldi 1995) stat nov. (Tab. 1, rel. 11-20; Tab. 2, ass. 4-5)

Syn: *Aquifolio-Fagetum* Ronsisvalle & Signorello 1977, Boll. Acc. Gioenia Sci. Nat. 13(1-2): 5, not Gentile 1969

Melitto albidae-Fagetum Ubaldi et al. 1990, Not. Fitosoc. 23: 53, nom. inval. (art. 5)

DIFFERENTIAL SPECIES: *Melittis albida, Polygonatum multiflorum, Symphytum gussonei, Limodorum abortivum, Saxifraga rotundifolia*, *Acer obtusatum* var. *aetnense*.

2. Melitto albidae-Fagetum Ubaldi et al. ex Ubaldi 1995, Ann. Bot. (Roma) 51, suppl. 10: 119. (Tab. 1, rel. 27-36)

Lectotype: rel. 19, Tab. 1, Ronsisvalle & Signorello 1977.

ECOLOGY: This subassociation substitutes the typical aspect on the siliceous substrata occurring in the submontain belt (1000-1300 m) characterized by a supramediterranean subhumid bioclimate. It is an extrazonal beech-wood linked to very humid microclimatic conditions like those occurring in the north-facing slopes of the valleys. In more sunny and exposed places, the association is substituted by the

Arrhenathero nebrodensis-Quercetum cerridis Brullo et al. 1996.

This beech-wood was formerly attributed by Ronsisvalle & Signorello (1977) to the *Aquifolio-Fagetum* Gentile 1969. Afterwards Ubaldi (1995) basing on the relevés published by Ronsisvalle & Signorello (l.c.), described the new association *Melitto albidae-Fagetum*, with two subassociations *typicum* and *paeonietosum*, whose ecological repartition was not specified by the same. In our opinion, for the notewothy affinitiy of this beech-wood to the acidophilous ones occurring on Nebrodi and Madonie ranges, it is better to consider it as a subassociation of the *Anemono apenninae-Fagetum*. The hollowed situation of its growing sites let the entrance of some species of the *Quercetalia pubescenti-petraeae* order, which in this context can be regarded as differentials of subassociation.

DISTRIBUTION: This association is localized in the W sector of Peloritani mountains (NE Sicily, fig. 5).

3. *Luzulo siculae-Fagetum* ass. nov. (Tab. 1, rel. 21-26; Tab. 2, ass. 6-7)

Syn: *Fagetum s.l.* Raimondo 1980, C.N.R. AQ/1/89: 28.

Olotype: rel. 22, Tab. 1.

DIFFERENTIAL SPECIES: *Cephalanthera rubra, Cephalanthera damasonium*.

ECOLOGY: Basiphilous beech forest linked to dolomitic and calcareous substrata, distributed in the mountain belt (1500-1900 m) characterized by a supramediterranean humid bioclimate. This association can be considered a southern vicariant of the *Carici albae-Fagetum* Moor 1952 (= *Cephalanthero-Fagetum* Oberd. 1957), calcicolous association of the *Cephalanthero-Fagion* (R.Tx. 1955) R. Tx. in R. Tx. & Oberd. 1958, distributed in the Central-European region (see Pott, 1995; Oberdorfer, 1992).

The association comes into contact in the lower belt with the *Aceri campestris-Quercetum ilicis* Brullo 1984 (*Quercetea ilicis*), while the degradation processes bring to the orophilous chamaephytic communities of *Cerastio-Astragalion nebrodensis* Pignatti & Nimis ex Brullo 1984 (*Cerastio-Carlinetea nebrodensis*). On screes, the *Luzulo siculae-Fagetum* gets in contact with the communities of *Linarion purpureae* Brullo 1984 (*Thlaspietea rotundifolii* Br.-Bl. 1948).

DISTRIBUTION: This association is up to now quoted only from Madonie mountains (N Sicily, Fig. 5).

4. *Epipactido meridionalis-Fagetum* ass. nov. (Tab. 1, rel. 27-31, Tab. 2, ass. 8)

Olotype: rel. 27, Tab. 1.

CHARACTERISTIC SPECIES: *Epipactis meridionalis, Cephalanthera maravignae*.

ECOLOGY: Silicicolous beech forest linked to volcanic substrata distributed in the mountain belt (1500-2000 m) characterized by a supramediterranean humid bioclimate. This beech-wood shows a pioneer behaviour, as the soil evolution of its growing sites is hindered by the frequent contribution in ashes and sands due to the volcanic activity. This is reflected by the relatively low number of species and especially by the poverty of character species of the *Doronico-Fagion*, requiring a well-matured humus.

The association comes into contact in the upper belt with the pulvinate orophilous communities of the *Rumici-Astragalion siculi* Poli 1965 (*Cerastio-Carlinetea nebrodensis*), while in the lower belt it is substituted by mesophilous deciduous oak-woods

belonging to the the *Quercenion dalechampii* Brullo 1984 (*Quercetea ilicis*) on deep soils and by pine-woods of *Pinus nigra* subsp. *calabrica* on rocky soils.

DISTRIBUTION: This association is exclusive of the Etna (NE Sicily, Fig. 5).

5. *Rubo aetnici-Fagetum* ass. nov. (Tab. 1, rel. 32-36; Tab. 2 ass. 9)

Olotype: rel. 32, Tab. 1.

CHARACTERISTIC SPECIES: *Acer obtusatum* var. *aetnense*, *Rubus aetnicus*, while *Pinus nigra* ssp. *calabrica*, *Vicia cassubica* and *Agropyron panormitanum* can be considered as differential species.

ECOLOGY: Silicicolous beech forest dwelling on volcanic substrata, linked to a supramediterranean subhumid-bioclimate and occurring in the valleys of the submountain-mountain belt (1000-1600 m) of the eastern slope of Etna volcano, where the condensation of the humid streams coming from the Ionian sea, in the most favourable microclimatic conditions lets to the beech to survive at an unusually low altitude. This association is localized within the belt characterized by the the climatophilous oak-wood *Vicio cassubicae-Quercetum cerridis* Brullo & Marcenò 1985, sometimes substituted by the edapho-xerophylous pine-woods of *Pinus nigra* subsp. *calabrica*. This association differs from the previous one because of the high-frequency of a nourished pool of transgressive species mainly belonging to the *Quercetalia pubescenti-petraeae* order, but the lack of the strictly orophilous orchids characterizing the previous association doesn't allow, however, to consider this extrazonal beech-wood as a subassociation of the *Epipactido meridionalis-Fagetum*.

DISTRIBUTION: This association is exclusive of the East-facing slope of Etna (NE Sicily, Fig. 5),

Conclusions

As shown by the biplots species/relevés (fig. 4), each community is well characterized by a set of species. The specific repartition, which turns out from the discontinue distribution of the character-species, can be explained by observing the synecological and chorological patterns of the Sicilian beech woods. In particular, the repartition of some of them is mostly influenced by the ecology: for example *Cephalanthera rubra* and *C. damasonium* are strictly basiphilous species and therefore well characterizing the *Luzulo siculae-Fagetum*; while *Acer obtusatum* var. *aetnense, Vicia cassubrica, Pinus nigra* ssp. *calabrica* and *Rubus aetnicus*, typically acidophylous species, differentiate the *Rubo aetnici-Fagetum*. For what concern the climatic exigences, *Ilex aquifolium* turns out to be the most oceanic species and therefore is particularly frequent in the sapling stratum of the *Anemono apenninae-Fagetum*, association linked to a very damp microclimate. Some more termophilous species, as *Melittis albida, Symphytum gussonei* and *Limodorum abortivum* characterize the subassociation *melittetosum albidae*, reaching the lowest altitude among the surveyed forests. Some other species are better correlated to the isolation of the Sicilian beech-woods and are the main responsible of their remarkable phytogeographical connotation: *Cephalanthera maravignae, Epipactis meridionalis* and *Rubus aetnicus* clearly belong to this group. It is interesting to note that the recent origin of this pool of endemics is probably to be related to the chronicle of the beech forests, which doesn't date back longer than the Quaternary.

All the surveyed associations, for the occurrence of *Anemone apennina, Geranium versicolor, Lamium flexuosum, Allium pendulinum, Doronicum orientale, Festuca exaltata, Luzula sicula, Euphorbia amygdaloides ssp. arbuscula, Ranunculus lanuginosus*, etc., are to be included in the alliance *Doronico-Fagion* Ubaldi *et al.* ex Ubaldi

1995 (= *Geranio-Fagion* Gentile, 1969 p.p.) belonging to *Fagetalia sylvaticae* Pawl. in Pawl. *et al*. 1928, order of the *Querco-Fagetea* Br.-Bl. & Vlieger in Vlieger 1937. This alliance, grouping the termophilous South-Apennine and Sicilian beech-woods, is characterized by some neoendemics, mainly derived from Centre-European taxa, and by pool of Balkanic elements that give proofs of the paleogeographic connections between the Italian and the Balkanic peninsulas which, in concurrence with the marine regressions, happened up to the last glaciation.

References

Braun-Blanquet J., 1967 – *Vegetationsskizzen aus dem Baskenland mit Ausblicken auf das wietere Ibero-Atlantikum. II Teil*. Vegetatio **14**: 1-126.

Brullo S., 1984a – *Contributo alla conoscenza della vegetazione delle Madonie (Sicilia settentrionale)*. Boll. Acc. Gioenia Sci. Nat. Catania, **16** (322): 351-420.

Brullo S., Di Martino A. and Marcenò C., 1977 – *La vegetazione di Pantelleria (Studio fitosociologico)*. Pubbl. Ist. Bot. Univ. Catania 110 pp.

Brullo S. and Grillo M., 1978 – *Ricerche fitosociologiche sui pascoli dei Monti Nebrodi (Sicilia settentrionale)*. Not. Fitosoc. **13**: 26-61.

Brullo S. and Marcenò C., 1985 – *Contributo alla conoscenza della classe "Quercetea ilicis" in Sicilia*. Not. Fitosoc. **19**(1): 183-229.

Brullo S., Minissale P., Signorello P. and Spampinato G., 1996 – *Contributo alla conoscenza della vegetazione forestale della Sicilia*. Coll. Phytosoc. **24**: 635-647

Brullo S., Minissale P. and Spampinato G., 1996 – *Caratteristiche bioclimatiche della Sicilia*. Giorn. Bot. Ital. **130**(1): 177-185.

Gentile S., 1969 – *Sui faggeti dell'Italia meridionale*. Atti Ist. Bot. Lab. Critt. Univ. Pavia, s. 6, **5**: 207-306

Hofmann A., 1960 – *Il faggio in Sicilia*. Flora et Vegetatio Italica **2**: 1-235. Sondrio.

Oberdorfer E., 1992 – Süddeutsche Pflanzengesellschaften Teil IV: Wälder und Gebüsche. Gustav Fischer Verlag, Jena, Stuttgart, New York.

Pignatti S., (1982) – *Flora d'Italia*. Edagricole, Bologna.

Pirola A. and Vecchio S., 1960 – *Osservazioni sulla vegetazione della valle di Calanna (Etna)*. Boll. Ist. Bot. Univ. Catania, **2**(2): 131-142.

Podani J., 1995 – Syn-Tax-pc. Computer programs for multivariate data analysis in Ecology and Systematics. Version 5.0. Scientia Publ. Budapest.

Poli E., 1965 – *La vegetazione altomontana dell'Etna*. Flora et Vegetatio Italica **5**: 1-241. Sondrio.

Poli E., Di Benedetto L., Ferlito N. and Lo Giudice R., 1979a – *Stazioni etnee di faggio a bassa quota*. Atti Acc. Gioenia Sci. Nat. Catania s. 7, **10**: 135-147.

Poli E, Lo Giudice R. and Ferlito N., 1979b – *La vegetazione della valle di S. Giacomo (Etna)*. Atti Accad. Gioenia Sci. Nat. Catania s. 7, **10**:253-319.

Poli E., Maugeri G. and Ronsisvalle G., 1981 – *Note illustrative della carta della vegetazione dell'Etna*. C.N.R., AQ/1/131. Roma.

Pott R., 1995 – Die Pflanzengesellschaften Deutschlands. 2 Aufl. Ulmer Verlag, Stuttgart.

Raimondo F.M., 1980 – *Carta della vegetazione di Piano della Battaglia e del territorio circostante (Madonie, Sicilia)*. C.N.R., AQ/1/336. Roma.

Ronsisvalle G. and Signorello P., 1977 – *Interesse naturalistico e fitosociologico delle faggete del Bosco di Malabotta (Montalbano Elicona, Monti Peloritani)*. Boll. Acc. Gioenia Sci. Nat. Catania **13** (1-2): 62-71.

Ubaldi D., 1995 – *Tipificazione di syntaxa forestali appenninici e siciliani*. Ann. Bot. (Roma), St. Terr. **51**, suppl. **10**: 113-127.

Ubaldi D., Zanotti A.L., Puppi G., Speranza M. and Corbetta F., 1990 – *Sintassonomia dei boschi caducifogli mesofili dell'Italia peninsulare*. Not. Fitosoc. **23**: 31-62.