

## SYNTAXONOMICAL SURVEY OF EUROPEAN BEECH FORESTS: SOME GENERAL CONCLUSIONS

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ABSTRACT. - A short overview is given about the historical development of syntaxonomy of European beech forests. Different solutions of classification have been proposed, following more or less two main approaches: Division of alliances and suballiances by ecologically or geographically orientated species groups.

A new classification of European beech forests is proposed with 8 (or more) geographically orientated alliances, which can be further divided into suballiances by ecological species groups. For each alliance character and differential species, nomenclatural type and the area is mentioned, based on a (non published) synthetic table, including 10.006 relevés from all parts of Europe. From this table also some overlapping species groups (a-n) are given.

KEY WORDS - beech forest, classification, ecological and geographical species groups, Europe, Fagion, syntaxonomical history

### INTRODUCTION

Beech forests play an important role in the (potential) natural vegetation of Europe. In many areas they form the dominant forest communities, containing numerous characteristic plant species. Therefore in literature we can find many proposals for syntaxonomical systems, ranging from the description of single communities up to the presentation of broad surveys. However, most of these studies are more or less regional, e.g. for central, southwestern or southeastern Europe. Only few attempts have been made to synthesize the available information on an European level. The following contribution tries to give some basic aspects for such a system, based on a large phytosociological synthetic table of mesic beech forests throughout Europe.

During the Rome symposium in 1997 a synthetic table was distributed to all participants. Some of them promised to provide further material in order to make this table more complete. However, until now there are still some gaps,

especially with respect to the beech forests in southern and northern Europe. Therefore I shall only present some general conclusions, based on character and differential species. The definite table will be published in a later paper.

## HISTORY OF ALLIANCES AND SUBALLIANCES OF BEECH FORESTS

Syntaxonomy of European beech forests has a long history, almost as long as the history of the Zürich-Montpellier School. Braun(-Blanquet) described in 1915 an “association à hêtre” from the Cevennes in southern France based on 14 relevés. He mentioned already different vegetation types (geographical races) : in the south, a basic unit with *Calamintha grandiflora*, *Dentaria heptaphylla*, *D. pentaphyllos*, *Doronicum austriacum*, *D. pardalianches*, *Geranium nodosum*, and *Luzula nivea*, in the eastern Alps with *Anemone trifolia*, *Cardamine trifolia* and *Dentaria polyphylla*. A northern race was mentioned that has hardly own elements. This first overview was already a “draft” of later syntaxonomical concepts.

The Fagion, that was described by Luquet (1926), was the first higher unit. His “association à *Fagus sylvatica*” contains among others *Scilla lilio-hyacinthus*, today a character species of *Scillo-Fagion* (see below). Also Pawlowski (in Pawlowski et al. 1928) proposed a *Fagion sylvaticae*; he further described the order *Fagetalia sylvaticae* with the association *Fagetum sylvaticae tatricum*. Tüxen and Diemont (1936) separated the mixed deciduous forests in the *Fraxino-Carpinion*.

In this first phase of syntaxonomical development several publications deal with the *Fagetum sylvaticae* and *Fagion*, partly on geographical criteria, leading to names like *Fagetum boreoatlanticum*. Environmental-floristic differentiation was mainly described on the level of subassociations; Tüxen (1937) for example distinguished five subassociations. Kuhn (1937), however, described already several associations of beech forests for southern Germany.

A second syntaxonomical phase began with a larger survey of Knapp (1942), who described the *Asperulo-Fagion*. Tüxen and Lohmeyer (in Tüxen 1954) separated the acidophilous beech forests and placed them in the *Luzulo-Fagion*. Tüxen (1955) distinguished three alliances in a floristic-ecological sense: *Asperulo-*, *Luzulo-* and *Cephalanthero-Fagion*. Oberdorfer (1957) described only one alliance Fagion with several suballiances. This second phase is mainly reflecting the central European situation, following the ideas of Oberdorfer and Tüxen.

In the sixties a third syntaxonomical phase can be distinguished that includes more and more other areas of Europe. Before then, only Horvat (1938) has described a separate alliance for southeastern Europe: *Fagion illyricum*. Now, new material was published from many parts of the beech area. In southeastern Europe Borhidi (1963) gave a first broad survey of beech and related forests within the *Fagion illyricum*; Soó (1962) separated the *Fagion medio-europaeum* and the *Fagion illyricum*. He published a large overview in 1964 with several geographically orientated alliances (e.g. the *Fagion dacicum* for eastern parts and the *Fagion austro-italicum* for Italy). These proposals were partly accepted by Horvat et al. (1974) and others. For the eastern Carpathians, Vida (1963) suggested a suballiance *Symphyto cordatae-Fagion*, later evaluated as an own alliance by Täuber (1982) and Coldea (1991).

In southwestern Europe, the first description of beech forests from Cantabria by Braun-Blanquet (1967) gave important impulses for further syntaxonomic studies. He described two new alliances: *Ilici-* and *Scillo (lilio-hyacinthi)-Fagion*. Other authors, e.g. Rivas-Martinez followed this proposals, however, partly ranking this units as suballiances within a large *Fagion sylvaticae*.

In central Europe, new ideas were published by Oberdorfer and Müller (1984). They enlarged the old *Fagion illyricum* from Horvat and Borhidi to the beech areas of the eastern and central Alps. Following the provisional nomenclature of Borhidi (1963), they called this alliance *Lonicero alpigenae-Fagion*.

A first attempt to a broad survey of beech forests was made by myself (Dierschke 1989a,1990), based on a synoptic table of species-rich beech woods in mesic habitats of western and central Europe. Within the *Fagion I* proposed several suballiances with regional differential species. Besides the already known *Asperulo-*, *Scillo-*, *Lonicero-* and *Symphyto-Fagenion*, I described the new *Endymio-Fagenion* for atlantic areas of northwestern France and Great Britain. Török *et al.* (1989) proposed for the invalid name *Fagion illyricum* the new name *Aremonio-Fagion*, also mentioned by Zukrigl (1989) and Mucina *et al.* (1993).

So, by and by, the knowledge of European beech forests has increased. At the moment only in southern France, Italy and Greece the syntaxonomical situation seems to be rather unclear. The beech forests of southern France were described as *Fagetum gallicum* or *Dentario heptaphyllidi-Fagetum*. They have floristic affinities as well to southern as to central Europe. A similar situation can be seen in Italy. Gentile (1969; 1974) described from the Apennines several associations and two alliances (or suballiances): *Geranio nodosi-Fagion* for the north and *Geranio striati-Fagion* for the south (the old *Fagion austro-italicum* from Soó 1964). From Corse Gamisans (1977) mentioned the *Galio rotundifoliae-Fagion*. In Greece Raus (1980) described the *Doronico orientalis-Fagenion moesiaca*. Dimopoulos and Georgiadis (1995) used the name *Fagion moesiacum hellenicum* (see already Horvat *et al.* 1974).

## DIFFERENT APPROACHES: ECOLOGICAL VERSUS GEOGRAPHICAL SPECIES GROUPS

The history of higher syntaxa of beech forests shows different approaches and many different solutions, resulting in a series of names. In the bibliography of *Quercus-Fagetea* by Tüxen *et al.* (1981) 68 names for alliances and suballiances for beech forests are mentioned. However, all syntaxonomical solutions can be reduced more or less to two main approaches:

1. Division by ecological species groups in three clusters of associations:
  - species-rich forests in mesic habitats (floristic center of beech woods).
  - species-rich forests in rather dry and warm habitats (with transitions to thermophilous forests of *Quercetalia pubescenti-petraeae*).
  - species-poor forests in acid habitats (with transitions to acidotolerant forests of *Quercetalia robori-petraeae*).

From many areas of Europe this differentiation is described with varying associations and partly also with own alliances or suballiances. Often we find the *Asperulo-* (= *Galio odorati-*), *Cephalanthero-* and *Luzulo-Fagion*.

2. Especially in species-rich areas with many own characteristic plant species, geographically orientated units have been established, e.g. the *Scillo-* and *Aremonio-Fagion* in southwestern and southeastern Europe, with further differentiation into association groups or suballiances by ecological species groups. Sometimes both approaches are mixed, e.g. geographically and ecologically orientated suballiances within the *Fagion sylvaticae*.

Now, I would suggest to classify the beech forests in Europe on the level of alliances on the basis of one criterium: ecological or geographical. Török et al. (1989) have analysed this question for Illyrian beech forests by multivariate methods and have found a clear prevalence of geographical species groups. First my own opinion was more the ecological solution with three main alliances and geographically orientated suballiances. However, after the study of more literature, especially of southeastern areas of Europe, the geographical version seems to be more appropriate, though not all geographically orientated alliances have good character species. But in this way syntaxonomical treatment in the area of each alliance is open for more individual differentiation in an ecological sense. Also the *Abies alba* forests can be easier incorporated.

In the meantime there is another discussion about the acidotolerant beech forests: more and more authors agree with their position within the *Quercetalia robori-petraeae*, as Müller (1991) proposed for the *Luzulo-Fagion* of central Europe. In this case the *Fagion* contains only species-rich beech forests of mesic to warmer habitats.

## PROPOSALS FOR A SYNTAXONOMICAL SYSTEM OF EUROPEAN BEECH FORESTS

If we accept a geographically orientated system of beech forests for Europe and separate the *Luzulo-Fagion*, the old name *Fagion sylvaticae* of Luquet (1926) is rather doubtful. Its original description is related to an association of *Scillo-Fagion*. Following the code of nomenclature (Barkman *et al.* 1986), the real name of *Scillo-Fagion* is *Fagion sylvaticae* Luquet 1926. In this meaning the name is used by Rivas-Martinez *et al.* (1991) for the beech forests of southwestern Europe. Consequently they take the next younger name for all beech forests of central Europe: *Luzulo-Fagion* Lohmeyer et Tüxen in Tüxen 1954. However, this is nomenclatural nonsense! Therefore I propose to reject the name *Fagion sylvaticae* as nomen ambiguum.

The following survey deals with species-rich mesic beech forests, based on the synthetic table already mentioned. In this table 10.006 relevés are included. The beech forests of rather dry and warm habitats can be incorporated, e.g. as suballiances like the *Cephalanthero-Fagenion*, perhaps with some small changes in the characteristic species combination of the alliances.

The alliances are characterised by their character and differential species (C/D) and/or by a specific combination of further important species groups (a-n) derived from the synthetic table. Also the nomenclatural Type (NT) is indicated.

In general a decreasing number of character species can be recognised from south to north. Therefore the northern and northwestern alliances can only be distinguished by few or no own species, better characterised by a specific combination of overlapping species groups.

QUERCO-FAGETEA Br.-Bl. et Vlieger in Vlieger 1937  
Fagetalia sylvaticae Pawl. in Pawl. et al. 1928

### **1. Scillo-Fagion Br.-Bl. 1967**

C/D: *Crepis lampsanoides*, *Euphorbia hyberna*, *Geranium nodosum*, *Helleborus viridis* ssp. *occidentalis*, *Meconopsis cambrica*, *Saxifraga hirsuta*, *S. umbrosa*, *Scilla lilio-hyacinthus*, *Scrophularia alpestris*.

Species groups: d,e,i.

NT: Scillo-Fagetum Br.-Bl. 1952 nom. inv.

Beech forests of the Pyrenees and northern Spain (347 relevés).

### **2. Endymio-Fagion (Dierschke 1989) all. nov.**

C/D: *Holcus mollis*, *Ruscus aculeatus*, *Scilla non-scripta*.

Species groups: d,e,f.

NT: Endymio-Fagetum Durin, Noirfalise et Sougnez 1967

Atlantic beech forests of northwestern France and England (282 relevés).

### **3. Aremonio-Fagion (I. Horvat 1938) Török, Podani et Borhidi 1989**

C/D: *Anemone trifolia*, *Cyclamen purpurascens*, *Epimedium alpinum*, *Galanthus nivalis*, *Haquetia epipactis*, *Helleborus niger*, *Homogyne sylvestris*, *Lamiastrum flavidum*, *L. orvala*, *Phyteuma ovatum*, *Ruscus hypoglossum*, *Tamus communis*, *Vicia oroboides*.

Species groups: d,e,f,g,k,l.

NT: *Lamio orvalae*-Fagetum (I. Horvat 1938) Borhidi 1963

Illyrian beech forests of southeastern Europe (510 relevés).

### **4. Symphyto cordatae-Fagion (Vida 1963) Täuber 1982**

C/D: *Dentaria glandulosa*, *Helleborus purpurascens*, *Pulmonaria rubra*, *Symphytum cordatum*.

Species groups: k,l.

NT: *Symphyto cordatae*-Fagetum Vida 1963

Beech forests of the Carpathians (1283 relevés).

### **5. Lonicero alpigenae-Fagion (Oberd. et Müller 1984) all. nov.**

C/D: -

Species groups: h,k.

NT: *Lonicero alpigenae*-Fagetum Oberd. et Müller 1984

Prealpine beech forests of southern Germany and adjacent areas (848 relevés).

### **6. Galio odorati (Asperulo)-Fagion Tx.1955**

C/D: -

Species groups: d,f,g,h.

NT: Hordelymo-Fagetum Kuhn 1937 em. Dierschke 1989, Müller 1989

Rather bad characterised beech forests of central and northern Europe (6305 relevés).

### **7. Geranio striati-Fagion Gentile 1969**

C/D: unclear

Species groups: l,m,n.

Beech forests of southern Italy.

### **8. Doronico orientalis-Fagion moesiaca (Raus 1980)**

C/D: unclear

Species groups: e,l,m,n.

Beech forests of Albania and Greece.

### **9. Beech forests of Switzerland and southwestern France**

Species group: n. (separate alliance?)

Overlapping species groups:

a) Widespread species with higher constancy within all alliances:

*Fagus sylvatica*, *Hedera helix*, *Lonicera xylosteum*.

*Anemone nemorosa*, *Athyrium filix-femina*, *Brachypodium sylvaticum*, *Dryopteris filix-mas*, *Epilobium montanum*, *Galium odoratum*, *Geranium robertianum*, *Milium effusum*, *Mycelis muralis*, *Oxalis acetosella*, *Poa nemoralis*, *Sanicula europaea*, *Veronica chamaedrys*, *Viola reichenbachiana*.

b) Widespread species, especially in alliances 1,2,5,6:

*Fraxinus excelsior*.

*Carex sylvatica*, *Circaea lutetiana*, *Dryopteris carthusiana* agg., *Euphorbia amygdaloides*, *Lamium galeobdolon*, *Lysimachia nemorum*, *Mercurialis perennis*, *Moehringia trinervia*, *Phyteuma spicatum*, *Polygonatum multiflorum*, *Primula elatior*, *Rubus fruticosus* agg., *Veronica montana*, *Vicia sepium*.

c) Widespread species without alliance 2:

*Abies alba*.

*Euphorbia dulcis*, *Festuca altissima*, *Fragaria vesca*, *Gymnocarpium dryopteris*, *Hepatica nobilis*, *Hieracium sylvaticum*, *Lilium martagon*, *Luzula sylvatica*, *Neottia nidus-avis*, *Paris quadrifolia*, *Polygonatum verticillatum*, *Prenanthes purpurea*, *Rubus idaeus*, *Solidago virgaurea*, *Stachys sylvatica*.

d) Species group for the alliances 1,2,3,6:

*Arum maculatum*, *Luzula pilosa*, *Melica uniflora*, *Stellaria holostea*.

e) Species group for the alliances 1,2 (3,7,8).

*Blechnum spicant*, *Ilex aquifolium*, *Pteridium aquilinum*.

f) Species group for the alliances 2,3,6.

*Carpinus betulus*, *Quercus petraea*, *Q. robur*.

g) Species group for the alliances 3,4,5,6 (7,8,9):

*Acer pseudoplatanus*, *Picea abies*.

*Actaea spicata*, *Asarum europaeum*, *Carex digitata*, *Daphne mezereum*, *Dentaria bulbifera*, *Lathyrus vernus*, *Luzula luzuloides*, *Maianthemum bifolium*, *Melica nutans*, *Pulmonaria officinalis* agg., *Scrophularia nodosa*, *Senecio fuchsii*.

h) Species group for the alliances 5,6:

*Atrichum undulatum*, *Hordelymus europaeus*.

i) Species group for the alliances 1,3,4,5 (7,8):

*Daphne laureola*, *Isopyrum thalictroides*, *Phyllitis scolopendrium*, *Polystichum aculeatum*.

k) Species group of the alliances 3,4,5 (7,8,9).

*Lonicera alpigena*, *L. nigra*.

*Adenostyles alliariae*, *A. glabra*, *Aposeris foetida*, *Cardamine trifolia*, *Dentaria enneaphyllos*, *Doronicum austriacum*, *Petasites albus*, *Rosa pendulina*, *Salvia glutinosa*, *Saxifraga rotundifolia*, *Symphytum tuberosum*, *Veronica urticifolia*.

l) Species group for the alliances 5,6 (7-8):

*Aremonia agrimonoides*, *Festuca drymeia*, *Gentiana asclepiadea*, *Polystichum lobatum*, *Potentilla micrantha*, *Primula vulgaris*, *Rubus hirtus* agg.

m) Species group for the alliances 7,8 (9).

*Cyclamen hederifolium*, *Euphorbia heldreichii*, *Galium rotundifolium*, *Geranium striatum*, *Lamium flexuosum*, *Lathyrus alpestris*, *L. laxiflorus*, *Orthilia secunda*, *Ranunculus umbrosus*.

n) Species group of alliances 7,8,9 (1):

*Calamintha grandiflora*, *Dentaria heptaphylla*, *Luzula nivea*.

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