TILIA-DOMINATED CALCICOLOUS FORESTS IN THE CZECH REPUBLIC FROM A CENTRAL EUROPEAN PERSPECTIVE

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ABSTRACT. - The *Seslerio albicantis-Tilietum cordatae* is described as a new association of the calcicolous forests in the Czech Republic. It includes species-rich *Tilia cordata* or *T. platyphyllos* dominated forests with a mixture of mesophilous forest species and thermophilous oak-forest species in the field layer, confined to shallow soils of the upper slopes. During the postglacial period, these forests probably developed from *Sesleria albicans*-grassland and *Corylus avellana*-scrub and preserved a number of relict species. Comparative analysis of selected literature data on Central European calcicolous forests dominated by *Tilia* species yielded 6 major floristically defined groups and a few communities of local importance. These groups include: (1) *Asperulo taurinae-Tilietum* of Swiss föhn valleys, (2) *Aceri-Tilietum* of central and southern Germany and NW Switzerland, (3) *Aceri-Carpinetum aconitetosum vulpariae* of the Czech Republic (nutrient-rich habitats), (4) *Seslerio albicantis-Tilietum cordatae* of the Czech Republic (nutrient-poor habitats), (5) *Mercuriali-Tilietum* of the Hungarian Central Range, (6) *Tilio-Fraxinetum excelsioris* of the Carpathian fringes in Hungary and Romania.

KEY WORDS - phytosociology, vegetation survey, relict

INTRODUCTION

In Central Europe, *Tilia cordata* and *Tilia platyphyllos* are common species in mesophilous forests. *Tilia cordata* seems to tolerate a broader spectrum of ecological factors and to have affinities to several community types, being a typical constituent of oak-hornbeam forests (*Carpinion*) and ravine forests (*Tilio-Acerion*), whereas *Tilia platyphyllos* is mainly confined to ravine forests (Fekete, 1965; Pigott, 1991; Ellenberg, 1996).

The ravine forests may be divided into thermophilous types of lower altitudes, dominated by lime, and montane types dominated by maple (Moor, 1975; Clot, 1990; Oberdorfer, 1992; Wallnöfer *et al.*; 1993). Low-altitudinal lime forests may be further divided into calcicolous and non-calcicolous types (Clot, 1990; Oberdorfer, 1992).

In the Czech Republic, calcicolous lime forests were studied by Husová (1982) who described a subassociation of *Aceri-Carpinetum aconitetosum vulpariae* to include forests on calcareous soils of lower slopes or ravines. During field research in limestone areas of the Czech Republic we observed that there is also another type of lime forest with a striking performance of the thermophilous oak-forest species on steep upper slopes. The present study summarizes the results of the field research and compares this type to other communities of calcicolous lime forests in Central Europe.

Methods

Field research followed the methods of the Braun-Blanquet approach (Westhoff & van der Maarel 1978, Dierschke 1994), with the 7-grade Braun-Blanquet scale used for sampling vegetation. All areas with limestone occurring at the lower altitudes in the Czech Republic were visited and natural *Tilia cordata-* or *Tilia platyphyllos*-dominated forests with thermophilous species of the *Quercetalia pubescenti-petraeae* in the undergrowth were sampled. Stands with few thermophilous oak-forest species and a higher proportion of *Carpinion*-species (*Aceri-Carpinetum aconitetosum vulpariae*, see Husová 1982) were not dealt with in the field research. As a rule, sample plots of 200 m^2 or larger were preferred but where the stand size was too small, plots smaller than 100 m^2 were also used to assure the within-sample homogeneity. Cryptogams were not included in this study.

The TURBO(VEG) package (Hennekens, 1995) was used for the analysis of field data and the accepted classification is largely based on the results of TWINSPAN classification (Hill, 1979). For comparison of the relevé data from the Czech Republic, selected vegetation tables on *Tilia*-dominated calcicolous forests from Central European literature were computerized in the form of constancy tables with constancy classes 1 to 5 (1 = 1-20 %, 2 = 21-40 %, etc.). Correspondence analysis of constancy tables, performed by CANOCO program (ter Braak, 1987), revealed the principal variation patterns among these forests. Subsequently, a synoptic table of Central European calcicolous lime forests was constructed with the order of communities roughly corresponding to the ordination results.

Species nomenclature follows Ehrendorfer (1973) with the exception of *Sesleria albicans* Kit. ex Schultes.

Results

Seslerio albicantis-Tilietum cordatae - a new association of calcicolous forests in the Czech Republic

Calcicolous lime forests with thermophilous oak-forest species were recorded in three areas of the Czech Republic (fig. 1): (1) Central Moravia (Moravian Karst, Javoříčko Karst), (2) Central Bohemia (Bohemian Karst, Křivoklát area, Džbán Mts.), (3) South Moravia (river valleys of the SE fringes of the Bohemian Massif, Pavlov Hills), with some localities in the adjacent area of Austria. Central Moravia is cooler and wetter, whereas the latter two areas are comparatively warm and dry. In South Moravia,

however, climatic continentality is more pronounced than in Central Bohemia. These macroclimatic differences account for differences in the species composition of the calcicolous lime forests studied (table 1). In the tree layer, for example, an admixture of *Picea abies* was recorded in Central Moravian stands. Its occurrence may be partly due to spreading from neighbouring conifer plantations but we assume at least some of the stands may support native spruce. In more continental South Moravia, on the other hand, mesophilous broad-leaved tree species such as *Fagus sylvatica, Acer platanoides* and *Fraxinus excelsior* are almost absent and *Pinus sylvestris* occurs in some stands, although its occurrence may be considered as native in a small part of the studied stands only. In addition the thermophilous oak-forest species are much more common in South Moravian stands.

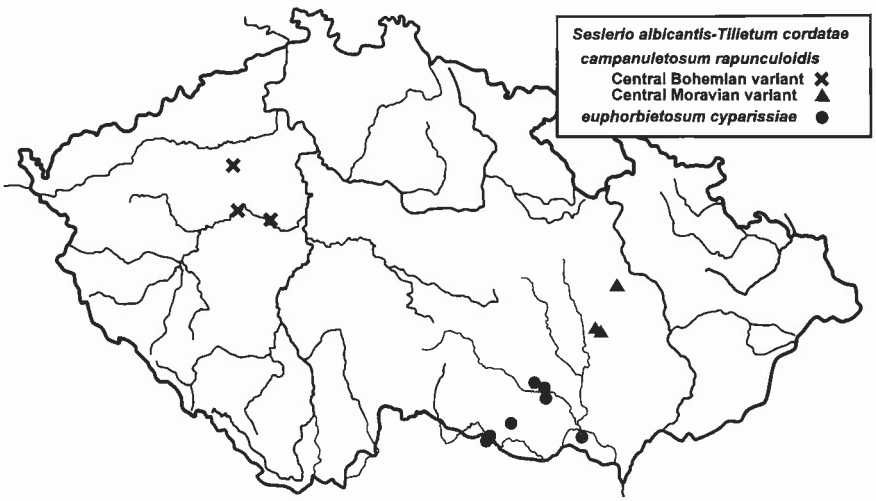

Fig. 1 - Distribution of the *Seslerio albicantis-Tilietum cordatae* in the Czech Republic.

Taking into account that the studied calcicolous lime forests are clearly distinct from similar Central European communities (table 2), we propose the following formal description of the observed pattern:

Seslerio albicantis-Tilietum cordatae ass. nova (Table 1, rels. 1-32; nomenclature type: Table 1, relevé 21)

S. a.-T. c. campanuletosum rapunculoidis subass. nova (Table 1, rels. 1-20; nomenclature type: Table 1, relevé 18) includes Central Moravian and Central Bohemian stands.

S. a.-T. c. euphorbietosum cyparissiae subass. nova (Table 1, rels. 21-32; nomenclature type: Table 1, relevé 21) includes South Moravian stands.

The *Seslerio albicantis-Tilietum cordatae* includes forests with a predominance of *Tilia cordata* or *Tilia platyphyllos*. In most stands several other tree species are also present such as *Carpinus betulus, Quercus petraea, Fagus sylvatica, Acer platanoides* etc. The shrub layer is vigorous and species-rich, with *Corylus avellana* being its most prominent constituent. The dominant species of the field layer is *Sesleria albicans*. This layer is also rich in species, being largely formed from a mixture of *Fagetalia* and *Quercetalia pubescenti-petraeae* species. Details of the species composition are evident from Table 1.

These forests are confined to steep upper slopes, typically with an inclination of 40-50°. On limestones or other calcareous bedrocks, such slopes support shallow rendzinas or pararendzinas, respectively. The variety of bedrock types includes Devonian or Silurian limestone in Moravian and Bohemian Karst, palaeobasalt (spilite) in the Křivoklát area, sponge-spicule marlstone in the Džbán Mts., marble, Permo-Carboniferous conglomerate or (rarely) gneiss in the valleys of the south-eastern fringes of the Bohemian Massif, and Jurassic limestone in the Pavlov Hills.

Lime forests are usually confined to steep upper parts of west- or north-facing slopes, whereas corresponding habitats of the south-facing slopes with shallow and comparatively dry soil support either thermophilous oak forest (*Corno-Quercetum*) or dry grassland in forest gaps. Compared with ravine forests (*Aceri-Carpinetum*) or oak-hornbeam forests (*Melampyro nemorosi-Carpinetum*) on the lower slopes, the soil on the upper slopes is not only drier but also poorer in nutrients due to the slight accumulation of litter. However, patches of nitrophilous species in the field layer suggest the hypothesis that soil nutrient content may vary markedly from place to place.

A striking feature of the *Seslerio-Tilietum* forests is a high concentration of species considered as relicts of different periods of vegetation history in particular areas (see Niklfeld, 1972, for the discussion of the relict status of some of them). These include among others *Aconitum anthora* (SW Moravia), *Arabis pauciflora*, *Arenaria grandiflora* (Pavlov Hills), *Erysimum odoratum* (Džbán Mts., Pavlov Hills), *Polygala chamaebuxus* (Džbán Mts.), *Saxifraga paniculata* (Moravian Karst, Bohemian Karst, Pavlov Hills), *S. sponhemica* (Oslava valley in SW Moravia), *Senecio integrifolius* (Pavlov Hills), *Sesleria albicans*, *Thesium bavarum* (Džbán Mts.), *Thlaspi montanum* (Bohemian Karst), *Viola saxatilis* (South Moravia). As all of these species are more or less heliophilous and their relict origin dates back to the pre-Holocene period, the existence of open patches with abundant light since the end of the last glacial must be assumed as a key factor responsible for their preservation. From this point of view, a tentative postglacial history of the *Seslerio-Tilietum* may be outlined as follows:

1. In the early Holocene, *Pinus sylvestris* and *Corylus avellana* spread into a *Sesleria* dominated grassland. However, *Corylus* failed to form a closed canopy on steep slopes. Consequently, most of the grassland species were preserved and perhaps some new steppe species arrived as the climate became progressively warmer. Later on, the spread of *Quercus petraea* may have occurred in some sites and consequently also the spread of thermophilous oak-forest species and species of oak-forest fringes.

2. In the postglacial climatic optimum, *Tilia* attained dominance in these habitats. Its broad-leaved canopy supported the spread of mesophilous forest species but gaps were always present at the same time for the survival of heliophilous grassland species. These gaps were partly on rock outcrops and cliffs, and partly they originated from treefalls. Treefall gap dynamics were most probably analogous to that observed in contemporary stands. On steep slopes *Tilia* often forms multi-stemmed trunks with clonal growth being no exception. Consequently, individual trees or clones occupy a comparatively large space and large gaps are formed following treefalls. The gaps are not colonized by dense scrub because the secondary succession is dominated by *Corylus* which is not able to form dense stands on steep slopes.

3. In the period of the spread of *Fagus* and *Carpinus,* some of the *Tilia*-dominated forests were invaded by these shading trees. However, they avoided habitats of steep upper slopes because of dryness, low nutrient status of the soil and disturbance by landslides. Even if they were able to establish themselves in some of these habitats, they failed to attain dominance. In this way the contemporary vegetation pattern was formed with small patches of the *Seslerio-Tilietum* in a complex with open *Sesleria* grassland and *Corylus* or *Cotoneaster integerrima* scrub, which is mostly surrounded by an oak-hornbeam forest of the *Melampyro nemorosi-Carpinetum* (fig. 2).

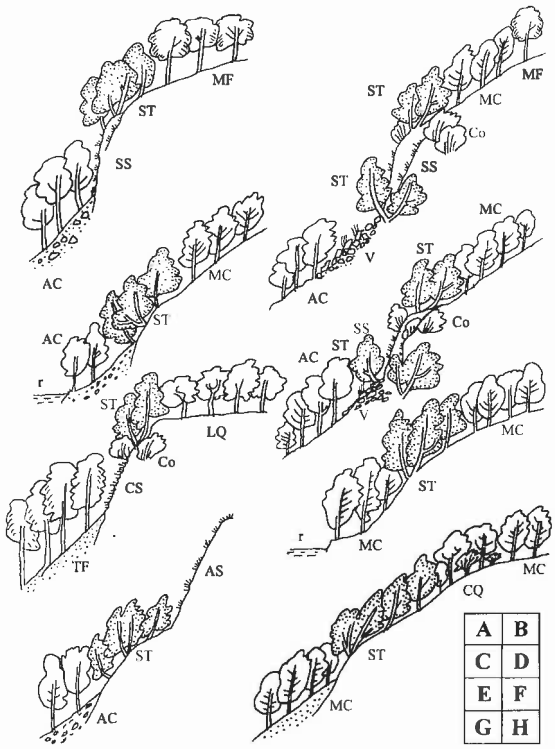

Fig. 2 - Position of the *Seslerio albicantis-Tilietum cordatae* in local vegetation zonations in different areas of the Czech Republic. Names of syntaxa follow Moravec et al. (1995).

A - Javoříčko Karst, N-facing slope (limestone)
B - Moravian Karst, slopes of various aspects (limestone)
C - Křivoklát area, NW-facing slope (palaeobasalt)
D - Bohemian Karst, slopes of various aspects (limestone)
E - Džbán Mts., W-facing slope (marlstone)
F - SW Moravia, W-facing slope in a river valley (marble)
G - Pálava Hills, N-facing slope (limestone)
H - SW Moravia, N- and W-facing slopes in the Rokytná valley (conglomerate)
ST - *Seslerio albicantis-Tilietum cordatae*
SS - *Saxifrago aizoi-Seslerietum calcariae*
CS - *Cirsio pannonici-Seslerietum calcariae*
AS - *Alsino setaceae-Seslerietum calcariae*
V - talus with *Vincetoxicum hirundinaria*
Co - *Corylus* and/or *Cotoneaster* scrub
AC - *Aceri-Carpinetum*
MC - *Melampyro nemorosi-Carpinetum*
MF - *Melico-Fagetum*
TF - *Tilio cordatae-Fagetum*
LQ - *Luzulo albidae-Quercetum petraeae*
CQ - *Corno-Quercetum*
r - river

POSITION OF THE *SESLERIO ALBICANTIS-TILIETUM CORDATAE* AMONG THE CENTRAL EUROPEAN *TILIA*-DOMINATED CALCICOLOUS FORESTS

Constancy table (table 2) and the ordination diagram based on this table (fig. 3) show the floristic variation pattern in the *Tilia*-dominated calcicolous forests across Central Europe. Six groups may be distinguished (fig. 4):

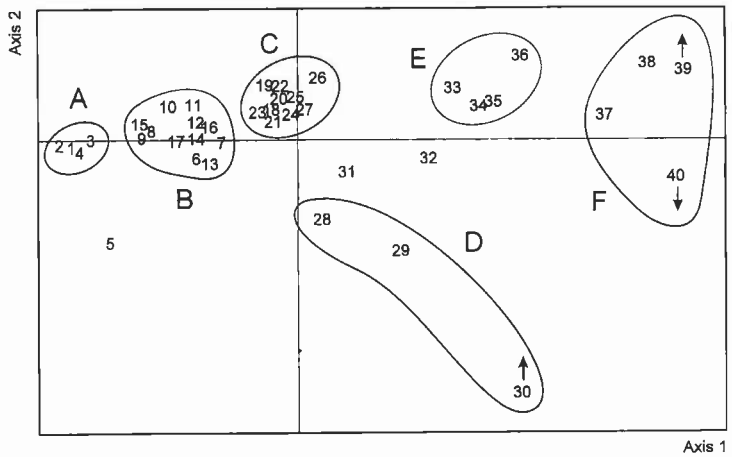

Fig. 3 - Correspondence analysis ordination diagram of the *Tilia*-dominated calcicolous forests in Central Europe. Capital letters refer to the groups discussed in the text; numbers denote the data sources listed in Appendix 2. Arrows pointing up or down indicate the communities with extreme (positive or negative, respectively) positions along ordination axis 3.

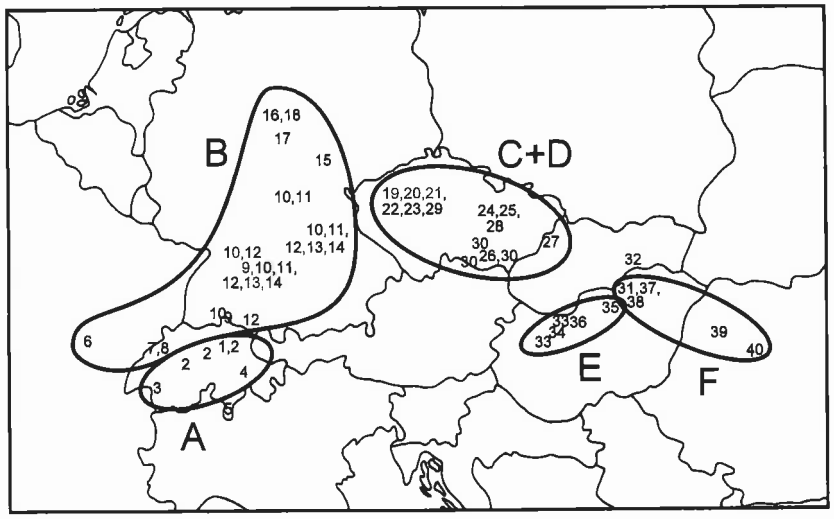

Fig. 4 - Geographical differentiation of the *Tilia*-dominated calcicolous forests in Central Europe. Capital letters refer to the groups discussed in the text; numbers denote the data sources listed in Appendix 2.

Group A includes the *Asperulo taurinae-Tilietum* Trepp 1947 from the föhn valleys in the lake district of the Swiss fringes of the Alps. The valleys at Walen, Vierstätter and Brienzer Lakes are comparatively warm due to the föhn effect, particularly in winter, spring and autumn. Also the growing season lasts longer. At the same time, however, these valleys receive high precipitation. In this area, lime forests are found on various calcareous rocks. They are mainly confined to lower slopes with an accumulation of soil and fine scree (Trepp, 1947; Ellenberg & Klötzli, 1972; Frey, 1995). As a rule, contact communities are beech forests such as the *Carici albae-Fagetum*. The species composition of this group is characterized by submediterranean species (*Coronilla emerus, Tamus communis*), subatlantic-submediterranean species (*Rosa arvensis*), subatlantic species (*Ilex aquifolium*), montane (*Veronica urticifolia*) and peri-alpine species (*Euonymus latifolia, Luzula nivea*). Closely related, although with a slightly different floristic composition, and isolated in the ordination diagram are the *Tilia* forests of alpine valleys in southern Graubünden (Trepp, 1947). These lime forests probably show close relationships to the southern alpine lime forests (Antonietti, 1968; Stampfli, 1986) that are not dealt with in this study.

Group B comprises the *Aceri-Tilietum* Faber 1936 (incl. *Vincetoxico-Tilietum* Winterhoff 1963, *Asperulo odoratae-Tilietum* Keller 1974) from limestone areas in central Germany (Winterhoff, 1963; 1965; Marstaller, 1972), southern Germany (Faber, 1936; Oberdorfer, 1992 and references cited therein), and NW Switzerland (Keller, 1974; Kissling, 1983; 1985). The area is under the strong influence of a mild sub-atlantic climate with comparatively high precipitation and a low annual temperature range. Consequently, contact communities are usually beech forests. The *Aceri-Tilietum* may be considered as the central association of the calcicolous lime forests in Central Europe, being characterized by only a few species with low constancy, among them common Central European species with broad ecological ranges. Some localities of the *Aceri-Tilietum* are possibly also found in Austria as may be concluded from the fragmentary data reviewed by Wallnöfer *et al.* (1993; sub *Cynancho-Tilietum platyphyllis* Winterhoff 1963). In the ordination diagram the *Seslerio-Tilietum platyphylli* Rameau 1973 from limestones in the Côte d'Or in Eastern France (Rameau, 1973) appears to be closely related to this group, although it is differentiated by a stronger submediterranean floristic influence (*Rhamnus alpinus, Prunus mahaleb,* etc.).

Group C includes the *Aceri-Carpinetum* Klika 1941 *aconitetosum vulpariae* Husová 1982 from limestones of the Bohemian Massif (Klika, 1942; Blažková, 1962, Samek, 1964; Šmarda, 1967, Husová; 1982) and the western fringes of the Carpathians (Neuhäusl & Neuhäuslová-Novotná, 1968; Fajmonová, 1974). Compared to Germany and NW Switzerland (Group B), temperature continentality increases and precipitation decreases in this area, thus promoting a widespread distribution of natural oak-hornbeam forests of the *Carpinion*. This is reflected in the group of differential species which is dominated by *Carpinion* elements such as *Pulmonaria officinalis* agg., *Asarum europaeum* and *Viola mirabilis*. Usually *Aceri-Carpinetum aconitetosum* is encountered in the lower parts of steep slopes, in ravines etc., whereas the *Carpinion* forest inhabits more gentle slopes without talus accumulation.

Group D is identical with the *Seslerio albicantis-Tilietum cordatae* described in this paper. Its distribution range overlaps the range of the *Aceri-Carpinetum aconitetosum* (Group C) so the mass effect of the *Carpinion* forests is also

conspicuous. However, it is confined to drier and nutrient-poorer habitats of the upper slopes. Consequently, Central European species of thermophilous oak forests and dry grasslands with sub-mediterranean or sub-continental ranges such as *Anthericum ramosum, Bupleurum falcatum* and *Stachys recta* are among differentials of the *Seslerio-Tilietum*. Striking differences between the sub-associations and variants within the *Seslerio-Tilietum* were revealed by correspondence analysis (Fig. 3), with *S.-T. euphorbietosum* being an outlier in the group of the Central European calcicolous lime forests.

Group E includes the *Mercuriali-Tilietum* Zólyomi et Jakucs ex Fekete et Járai-Komlódi 1962 from the Hungarian Central Range (Zólyomi, 1958; Fekete & Járai-Komlódi, 1962; Isépy, 1968; Kovács, 1968). It is an association of nutrient-rich soils on lower slopes with a number of *Carpinion* species (*Corydalis cava, C. solida, Adoxa moschatellina*) and eastern or south-eastern elements such as *Euonymus verrucosa, Galium schultesii, Waldsteinia geoides*). Similar communities were described from the Mecsek Mts. in southern Hungary (Horvát, 1972) and the Mureşvalley in western Romania (Täuber, 1986).

In the Hungarian Central Range and the southern fringes of the Western Carpathians, two communities of local distribution with a peculiar floristic composition were also reported, viz the *Tilio-Sorbetum* Zólyomi et Jakucs ex Zólyomi 1967 from the highest altitudes of the Bükk Mts. (Zólyomi, 1967) and the *Seslerio heufleranae-Quercetum petraeae* Šomšák et Háberová 1979 from the Slovakian Karst (Šomšák & Háberová, 1979). The former community is clearly distinct from the other Central European lime forests due to the frequent occurrence of montane species such as *Calamagrostis varia, Clematis alpina, Valeriana tripteris* and *Cimicifuga europaea*. The latter community is differentiated by *Poa stiriaca*.

Group F includes the *Tilio-Fraxinetum* Zólyomi ex Raţiu et al. 1966 from the Bükk Mts. in Hungary and the Carpathian fringes in NE Romania (Zólyomi, 1936; 1967; Gergely, 1962; Raţiu *et al.*, 1966). It is found on steep slopes and rock outcrops over limestone, or less commonly over other basic bedrocks. The patches of this community are encountered in the altitudinal belts of both oak-hornbeam and beech forests. The stands taken for comparison are quite heterogeneous as far as its floristic composition is concerned (see also fig. 3). Nevertheless, they are clearly separated from the other communities by species such as *Hesperis matronalis* agg., *Scutellaria altissima* and others.

Affinities of the *Tilia*-dominated calcicolous forests to the high-rank syntaxa

The syntaxonomical position of the *Tilia*-dominated calcicolous forests has been repeatedly debated because of the presence of both *Fagetalia* and *Quercetalia pubescenti-petraeae* species. For example the *Aceri-Tilietum* and *Tilio-Fraxinetum* were assigned to the *Quercetalia pubescenti-petraeae* by Oberdorfer (1957) and Zólyomi & Jakucs (1957), respectively. A similar solution was accepted by Rivas-Martínez *et al.* (1991) for analogous lime forests from the south-western Pyrenees and such a possibility, among others, was also discussed for the *Seslerio-Tilietum euphorbietosum* by Chytrỳ & Vicherek (1995). Taking into account the prominent performance of the *Fagetalia* species in all of

the communities synthetized in Table 2, we suggest assigning them to the alliance of the *Tilio-Acerion* Klika 1955 and the suballiance of the *Tilienion platyphylli* (Moor 1975) Müller in Oberdorfer 1992 which includes more or less thermophilous lime forests with *Quercetalia pubescenti-petraeae* species (Moor, 1975; Clot, 1990; Oberdorfer, 1992).

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APPENDIX 1. LOCALITIES OF RELEVÉS (TABLE 1).

1. Javoříčko Karst: Javoříčko, Zkamenělý zámek Cliff, rocky slope near the top (Sádlo)
2-5. Moravian Karst: Blansko-Těchov, Suchý žleb Valley, Sluneční Cliffs (Sádlo)
6. Moravian Karst: Blansko-Těchov, Suchý žleb, slope below the rock near Zbojnická Cave (Sádlo)
7-8. Moravian Karst: Blansko-Těchov, Skalní mlýn, talus slope below Prasečí ucho Cliff (Sádlo)
9-13. Džbán Mts.: Kozojedy, Pochválovská stráň Reserve 1 km SE of Děvíč settlement, slope above the cliffs (Sádlo)
14. Křivoklát area: Roztoky, Stříbrný luh Reserve, rocky talus slope (Sádlo)
15-17. Bohemian Karst: Svatý Jan pod Skalou, rocky slopes S of the church (Sádlo)
18-19. Bohemian Karst: Svatý Jan pod Skalou, talus slope below Dušičková Cliff (Sádlo)
20. Bohemian Karst: Karlštejn, Velká Hill (Klika 1942, tab. 1, rel. 20)
21. SW Moravia: Senorady, Oslava Valley (Chytrý & Vicherek 1996, tab. 16, rel. 5)
22. SW Moravia: Cučèice, Oslava Valley (Chytrý & Vicherek 1996, tab. 16, rel. 6)
23. SW Moravia: Oslavany, Oslava Valley (Chytrý & Vicherek 1996, tab. 16, rel. 7)
24-25. SW Moravia: Rokytná, Rokytná Valley (Chytrý & Vicherek 1996, tab. 16, rel. 8-9)
26. SW Moravia: Rudlice, cliff above the left bank of the Jevišovka River 1 km SW of the village (Chytrý & Rafajová)
27. SW Moravia: Lukov, Dyje Valley (Chytrý & Vicherek 1995, tab. 8, rel. 3)
28-29. Lower Austria: Hardegg, Thaya Valley (Chytrý & Vicherek 1995, tab. 8, rel. 2, 4)
30. Lower Austria: Hardegg, Fugnitz Valley (Chytrý & Vicherek 1995, tab. 8, rel. 6)
31. Pavlov Hills: Horní Věstonice, NW slope of Děvín Hill 1 km SE of SE margin of the village (Chytrý)
32. dtto. (Danihelka)

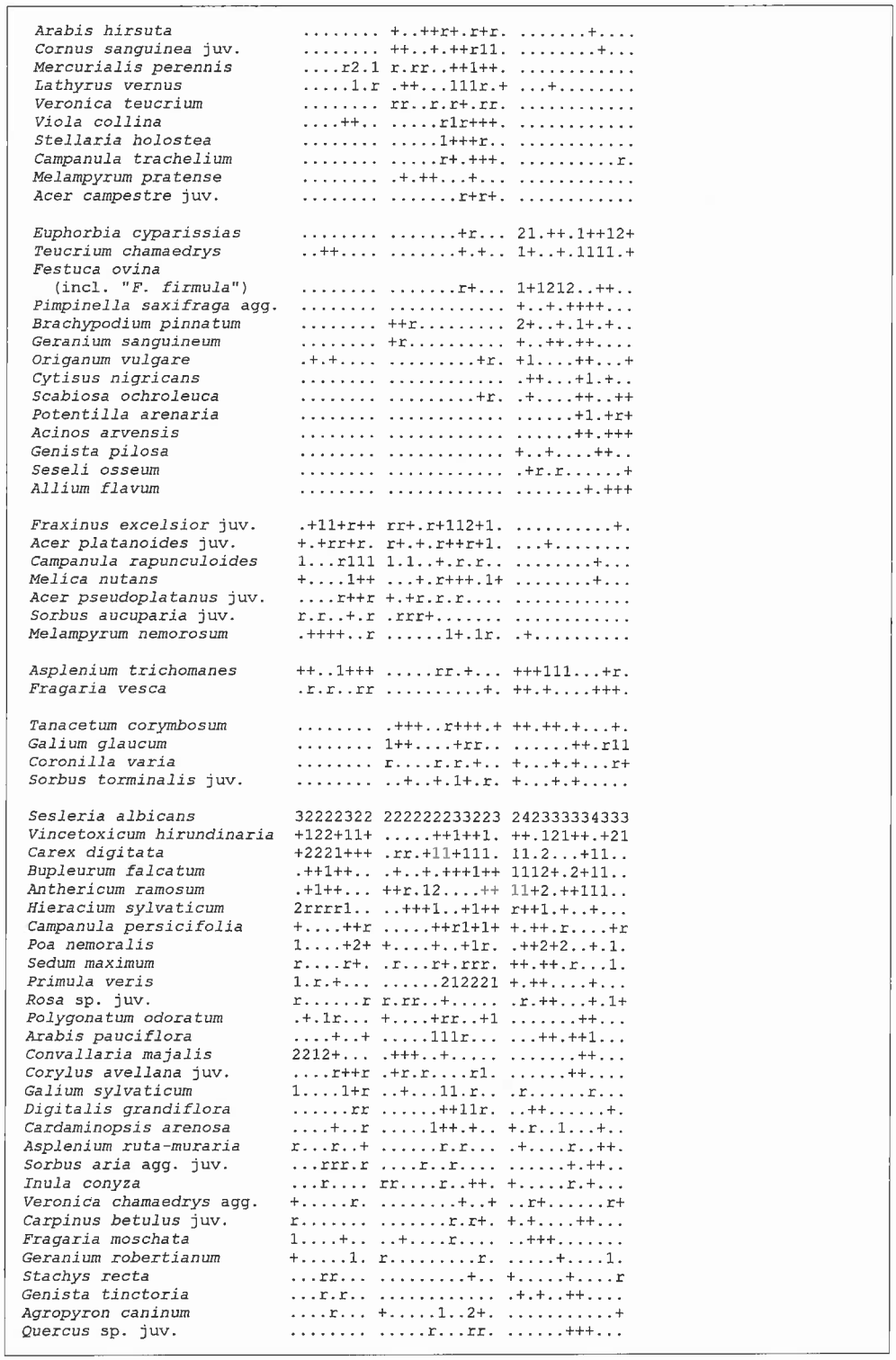
APPENDIX 2. SOURCES OF DATA IN THE SYNOPTIC TABLE (TABLE 2).

1. Frey (1995): Table 4, relevé groups 10-12, *Asperulo taurinae-Tilietum* (*aegopodietosum, typicum, tametosum*), Walensee area, Switzerland
2. Trepp (1947): Table I, rels. 1-65, *Tilieto-Asperuletum taurinae*, Walensee, Vierwaldstättersee and Brienzersee area, Switzerland
3. Trepp (1947): Table II, rels. 1-6, *Acer opalus*-rich mixed lime forest, SW Switzerland
4. Trepp (1947): Table III, rels. 1-4, mixed lime stands, alpine dry valleys in Canton Graubünden, Switzerland
5. Trepp (1947): Table IV, rels. 1-4, mixed lime stands, valleys in southern Graubünden, Switzerland
6. Rameau (1973): Table V, 20 rels., *Seslerio-Tilietum*, Côte d'Or, France
7. Kissling (1985): rels. 1-19, *Aceri-Tilietum platyphyllis* (lapiez: *polypodietosum*), Central Jura, Switzerland
8. Kissling (1985): rels. 20-39, *Aceri-Tilietum platyphyllis* (blocs, éboulis), Central Jura, Switzerland
9. Oberdorfer (1992): Table 319, column 6F, *Aceri platanoidis-Tilietum platyphylli, Hylocomium splendens* subass., Schwäbische Alb and Hegau, Germany
10. Oberdorfer (1992): Table 319, column 6E, *Aceri platanoidis-Tilietum platyphylli, Aegopodium podagraria* subass., Fränkische and Schwäbische Alb, the Wutach and Neckar area, Steigerwald, Germany
11. Oberdorfer (1992): Table 319, column 6D, *Aceri platanoidis-Tilietum platyphylli, Stachys sylvatica* subass., Fränkische and Schwäbische Alb, Steigerwald, the Neckar area, Germany
12. Oberdorfer (1992): Table 319, column 6C, *Aceri platanoidis-Tilietum platyphylli*, typical subass., Fränkische and Schwäbische Alb, southern hilly lands, the Neckar and Bodensee area, Germany
13. Oberdorfer (1992): Table 319, column 6B, *Aceri platanoidis-Tilietum platyphylli, Sesleria albicans* subass., Fränkische and Schwäbische Alb, Ammergauer Bergen, Germany
14. Oberdorfer (1992): Table 319, column 6A, *Aceri platanoidis-Tilietum platyphylli, Vincetoxicum hirundinaria* subass., Fränkische and Schwäbische Alb, Germany
15. Marstaller (1972): Table 3, rels. 1-4, *Aceri-Tilietum*, Thüringen, Germany
16. Winterhoff (1963): Table V, column A, *Acero-Tilietum*, Göttinger Wald, Germany
17. Winterhoff (1965): Table 8, columns b-d, *Vincetoxico-Tilietum*, Werrabergland, Germany
18. Winterhoff (1963): Table V, column B, *Vincetoxico-Tilietum*, Göttinger Wald, Germany
19. Klika (1959): Table II, rels. 1-12, *Acereto-Carpinetum*, Křivoklát area, Czech Republic
20. Husová (1982): Table 2, rels. 26-33, *Aceri-Carpinetum aconitetosum vulpariae*, Bohemian Karst, Czech Republic
21. Blažková (1962): pp. 282-284, rels. 1-9, *Acereto-Carpinetum calcareum*, Bohemian Karst, Czech Republic
22. Klika (1942): Table 2., rels. 1-22, *Acereto-Carpinetum calcareum*, Bohemian Karst, Czech Republic
23. Samek (1964): Table XII, rels. 3-14, *Acereto-Carpinetum* (*calcicolum*), Bohemian Karst, Czech Republic

24. Husová (1982): Table 2, rels. 34-42, *Aceri-Carpinetum aconitetosum vulpariae*, Moravian Karst, Czech Republic
25. Šmarda (1967): pp. 142-144, rels. 9-11, *Tilieto-Aceretum*, Moravian Karst, Czech Republic
26. Neuhäusl & Neuhäuslová-Novotná (1968): Table 14, rels. 58-62, *Aceri-Tilietum cordatae*, Pavlov Hills, Czech Republic
27. Fajmonová (1974): Table 2, rels. 1-8, *Aceri-Tilietum*, Karpatenrasse, Middle Váh area, Slovakia
28. this paper, Table 1, rels. 1-8, *Seslerio albicantis-Tilietum cordatae campanuletosum rapunculoidis*, Central Moravia, Czech Republic
29. this paper, Table 1, rels. 9-20, *Seslerio albicantis-Tilietum cordatae campanuletosum rapunculoidis*, Central Bohemia, Czech Republic
30. this paper, Table 1, rels. 21-32, *Seslerio albicantis-Tilietum cordatae euphorbietosum cyparissiae*, Southern Moravia, Czech Republic
31. Zólyomi (1967): pp. 31-32, *Tilio-Sorbetum*, Bükk, Hungary
32. Šomšák & Háberová (1979), Table 4, rels. 1-14, *Seslerio heufleranae-Quercetum petraeae*, Slovakian Karst, Slovakia
33. Fekete & Járai-Komlódi (1962): rels. 1-30, *Mercuriali-Tilietum scutellarietosum columnae*, Gerecse and Bakony Mts., Hungary
34. Isépy (1968): Table 2, rels. 1-10, *Mercuriali-Tilietum*, Vertés Mts., Hungary
35. Kovács (1968): Table1, rels. 1-10, *Mercuriali-Tilietum*, Mátra Mts., Hungary
36. Zólyomi (1958): pp. 570-572, *Mercuriali-Tilietum matricum*, Budai Mts., Hungary
37. Zólyomi (1967): pp. 36-37, *Tilio-Fraxinetum excelsioris*, Bükk, Hungary
38. Zólyomi (1936): p. 169, *Tilio-Fraxinetum excelsioris*, Bükk, Hungary
39. Raţiu et al. (1966): pp. 248-251, *Tilio-Fraxinetum*, Crişul Repede Valley, Romania
40. Gergely (1962): pp. 281-282, 2 rels., *Tilieto-Fraxinetum transsilvanicum*, . Trascăului Mts., Romania

TABLE 1 - *SESLERIO ALBICANTIS-TILIETUM CORDATAE*
1-8 *S. A.-T. C. CAMPANULETOSUM RAPUNCULOIDIS*, CENTRAL MORAVIAN VARIANT
9-20 *S. A.-T. C. CAMPANULETOSUM RAPUNCULOIDIS*, CENTRAL BOHEMIAN VARIANT
21-32 *S. A.-T. C. EUPHORBIETOSUM CYPARISSIAE*

Relevé nr.	11111111112 222222222333 12345678 901234567890 123456789012
E_3 - tree layer	
Picea abies	..111+12 ....
Quercus petraea	21..... 211.+212+11. ....3.....
Pinus sylvestris	.... .1....3.2+..
Fagus sylvatica	223.+..+ ..2..++1+2.. .....1...
Acer platanoides	.112+... 1..12..+.+2. .....
Fraxinus excelsior	..121.22 .....11..1. .....
Tilia cordata	33334433 .2.....1.. 13..2.2323..
Tilia platyphyllos	..... 344333322233 3.3425..1.44
Carpinus betulus	2..... 11...32242.1 2.322..23...
Sorbus aria agg.	..... 11122..... 1.....12..
Acer pseudoplatanus	....1.2. +.....+. .....
Sorbus torminalis	....21....+ 1.....
E_2 - shrub layer	
Berberis vulgaris	.1.11r+1 .....+...r. .....21+..
Cornus sanguinea	1..... 22rr++2..11. ....+.....
Quercus petraea	..... +..2r.++...1 ...1.....
Sorbus torminalis	....1..1..r..+ .....
Lonicera xylosteum	r...r1r. .r....+r1r+. .....+...
Fraxinus excelsior	.++.+.+. .....+rr1. .....
Sorbus aria agg.	.2122.12 .....+ ...21..312..
Euonymus verrucosa	.11..+.+ .....:... 2.+.+...++1.
Corylus avellana	.+222.22 2.1221+1r+2. 2222....112.
Cornus mas	.112.... ..1...22.2+. .....1.122.
Tilia cordata	.1...2.+ .....r.+. .1+.....22..
Cotoneaster integerrimus	2..... .....r++rr.+ .....++..
Carpinus betulus	+..... .....1+.r. ..2.....1+..
Sorbus aucuparia	+....1.. 1...+..... .....
Acer pseudoplatanus	r...r1.. .....r... .....
Taxus baccata	.+..... .....2+..+.. .....
Rosa canina	..... +1..+..... ....1.....
Acer platanoides	2..... ..r....+.... .....
Ligustrum vulgare	.+.++... ....
Rhamnus catharticus	....+... +...r..... .....
Tilia platyphyllos	....1..... 1....1.....
E_1 - field layer	
Mycelis muralis	r.r..rrr ...r....r.r. .....
Galium pusillum agg.	.++..r1r ..... .+++.1.....
Lamiastrum montanum	...rr+1+ .....r... .....
Berberis vulgaris juv.	.+1+...r .....r.... .....
Seseli libanotis	.rr+r... ....+.2..
Taxus baccata juv.	....r++r ....
Hepatica nobilis	1..... .++..r22111+ .....+...


Arabis hirsuta
Cornus sanguinea juv.
Mercurialis perennis
Lathyrus vernus
Veronica teucrium
Viola collina
Stellaria holostea
Campanula trachelium
Melampyrum pratense
Acer campestre juv.
Euphorbia cyparissias
Teucrium chamaedrys
Festuca ovina
(incl. "F. firmula")
Pimpinella saxifraga agg.
Brachypodium pinnatum
Geranium sanguineum
Origanum vulgare
Cytisus nigricans
Scabiosa ochroleuca
Potentilla arenaria
Acinos arvensis
Genista pilosa
Seseli osseum
Allium flavum
Fraxinus excelsior juv.
Acer platanoides juv.
Campanula rapunculoides
Melica nutans
Acer pseudoplatanus juv.
Sorbus aucuparia juv.
Melampyrum nemorosum
Asplenium trichomanes
Fragaria vesca
Tanacetum corymbosum
Galium glaucum
Coronilla varia
Sorbus torminalis juv.
Sesleria albicans
Vincetoxicum hirundinaria
Carex digitata
Bupleurum falcatum
Anthericum ramosum
Hieracium sylvaticum
Campanula persicifolia
Poa nemoralis
Sedum maximum
Primula veris
Rosa sp. juv.
Polygonatum odoratum
Arabis pauciflora
Convallaria majalis
Corylus avellana juv.
Galium sylvaticum
Digitalis grandiflora
Cardaminopsis arenosa
Asplenium ruta-muraria
Sorbus aria agg. juv.
Inula conyza
Veronica chamaedrys agg.
Carpinus betulus juv.
Fragaria moschata
Geranium robertianum
Stachys recta
Genista tinctoria
Agropyron caninum
Quercus sp. juv.

Dactylis polygama	.....	.....+.+...	++..1.....+
Galium odoratum	.....+.	rr.2....1...	.....
Ligustrum vulgare juv.	.+..r...	.....1r.	.....+...
Rhamnus cathartıcus juv.	.r.....	.....r...rr.	...+.....
Poa angustıfolıa	+.....	.....++...	.....++
Silene nutans	+.....	.+.....+.1.	.....+.....
Epıpactis helleborıne	...rrr..	.....++.	.....
Sılene vulgaris	....r...	.....	...12.....+1
Erysımum odoratum	.....	++..+.....	.....++
Aster amellus	.....	+...r.....	.+....++....
Tılıa platyphyllos juv.	.....	r.+.rr.....	.....+.....
Galium album	.....	.+.....	++..1.....+.
Valerıana wallrothii	.....	.....r+..+.	...+.....1.
Asperula cynanchıca	.....	.....r....	.....+++...+
Tılıa cordata juv.	...+..++	.....r...	.....
Polypodıum vulgare	r....+r.	.....r...	.....
Fagus sylvatica juv.	.....rr	.....r.+..	.....
Lılıum martagon	.....r.	.....r+.+...	.....
Euonymus verrucosa juv.	.r..r..r	.....	...+.....
Lonıcera xylosteum juv.	r.....+	.....+.....	...+.....
Crataegus sp. juv.	r.....	.....r.r.	.....r
Festuca pallens	r.....	.....	.....+....1+
Saxifraga panıculata	.....r..	.....r..r.	.....+
Centaurea triumfettıı	.....	.....r.r....	.....++
Helıanthemum ovatum	.....	.....+.r..	.....++....
Hyperıcum perforatum	.....	.....r.r.	+.....+.
Solıdago vırgaurea	.....	.....	+.+..+..r...
Myosotis sylvatıca	+.....+.	...+.....	.....
Hieracium sabaudum	.+.....	.....	r..+.....
Euphorbıa polychroma	..r.r...	.....	.+.....
Bromus benekenii	...r..+r	.....	.....
Senecio nemorensis agg.	...r..r.	r.....	.....
Dryopterıs filix-mas	.....+2r	.....	.....
Gymnocarpium robertianum	.....+++	.....	.....
Clinopodium vulgare	.....r.	.....	+.....+...
Anthriscus sylvestrıs	.....r.	.....	.....+r
Polygala chamaebuxus	.....	+.r.+.....	.....
Inula salicına	.....	rr.+.....	.....
Asperula tınctorıa	.....	r...r.....+	.....
Inula hırta	.....	r.....	1.....+..
Peucedanum cervarıa	.....	r.....	rr.....
Avenella flexuosa	.....	.+.r.....	.....+.....
Campanula gentilıs	.....	...r..r...r.	.....
Fragarıa vırıdıs	.....	.....+.....+	.....+.....
Aurınıa saxatılıs	.....	.....r..r..	.....r.
Dıctamnus albus	.....	.....r.+	....+.....
Luzula luzuloıdes	.....	.....r..	..++.....
Carex humilıs	.....	.....r2	.....2.....
Thymus praecox	.....	.....	+....+...+..
Melıca cılıata	.....	.....	++...1.....
Allium montanum	.....	.....	++...+.....
Phleum phleoides	.....	.....	r.....11
Cyclamen purpurascens	.....	.....	.+r.....+...
Campanula moravica	.....	.....	..+..+....r.
Achillea millefolium agg.	.....	.....	.....+....++
Arabis turrıta	.....	.....	.....++..+.

In one or two relevés only:
E_3: *Ulmus glabra* 9:1, 10:+, *Larix decidua* 22:+, *Betula pendula* 22:+, *Quercus robur* 30:1,

E_3 - epiphytes: *Viscum laxum* 9:+, 27:+;

E_2: *Fagus sylvatica* 1:1, 18:r, *Acer campestre* 1:r, 17:+, *Picea abies* 3:r, 22:1, *Sambucus nigra* 7:+, 12:1, *Quercus robur* 9:r, 28:1, *Euonymus europaea* 12:1, 26:2, *Ribes alpinum* 15:r, 19:r, *Juniperus communis* 27:1, 30:+, *Viburnum lantana* 28:1, 29:1, *Malus sylvestris* 1:+, *Ulmus glabra* 12:+, *Crataegus laevigata* 17:r, *Rosa* sp. 21:+, *Abies alba* 21:+, *Pinus sylvestris* 22:+, *Daphne mezereum* 29:+,

E_1: *Cystopteris fragilis* 1:r, 3:+, *Epilobium montanum* 1:r, 26:+, *Actaea spicata* 6:+, 7:r, *Urtica dioica* 6:+, 7:r, *Pimpinella major* 7:+, 8:r, *Chelidonium majus* 9:+, 31:+, *Rubus fruticosus* agg. 9:r, 10:+, *Ribes uva-crispa* juv. 9:r, 12:r, *Thesium bavarum* 9:r, 11:r, *Vaccinium vitis-idaea* 11:+, 12:r, *Ulmus glabra* juv. 11:r, 31:+, *Taraxacum officinale* agg. 12:r, 24:+, *Melittis melissophyllum* 13:+, 22:r, *Clematis recta* 14:r, 15:r, *Fallopia convolvulus* 14:r, 15:r, *Pulmonaria obscura* 15:r, 18:r, *Asarum europaeum* 16:r, 17:r, *Alliaria petiolata* 18:+, 31:1, *Silene nemoralis* 18:r, 20:1, *Carex*

montana 20:1, 22:+, *Viola hirta* 20:+, 22:+, *Verbascum austriacum* 21:+, 27:+, *Carlina intermedia* 22:+, 27:+, *Silene nutans* 33:+, 35:+, *Sedum album* 25:+, 32:+, *Asplenium septentrionale* 26:+, 30:+, *Impatiens parviflora* 26:+, 31:+, *Moehringia trinervia* 26:+, 31:+, *Inula ensifolia* 27:+, 28:2, *Thesium linophyllon* 28:+, 30:+, *Geum urbanum* 31:1, 32:+, *Arrhenatherum elatius* 31:+, 32:+, *Sedum acre* 31:+, 32:+, *Viola saxatilis* 31:+, 32:+, *Saxifraga tridactylites* 1:+, *Asplenium viride* 6:+, *Picea abies* juv. 6:+, *Knautia drymeia* 6:r, *Brachypodium sylvaticum* 6:r, *Oxalis acetosella* 7:r, *Galium aparine* 7:+, *Epilobium collinum* 7:+, *Myosotis sparsiflora* 1:r, *Melampyrum cristatum* 10:r, *Potentilla alba* 10:r, *Pinus sylvestris* juv. 10:r, *Galium boreale* 12:r, *Thalictrum minus* 15:+, *Laserpitium latifolium* 15:1, *Scabiosa columbaria* 16:r, *Festuca rupicola* 16:r, *Hierochloë australis* 16:r, *Rosa rubiginosa* juv. 16:r, *Viola reichenbachiana* 16:r, *Ajuga genevensis* 17:r, *Artemisia campestris* 18:r, *Lonicera caprifolium* juv. 19:+, *Ribes alpinum* juv. 19:r, *Odontites lutea* 19:r, *Hieracium bauhinii* 20:+, *Lathyrus pannonicus* ssp. *collinus* 20:+, *Trifolium alpestre* 20:+, *Thlaspi montanum* 20:+, *Linaria genistifolia* 21:+, *Sedum sexangulare* 21:r, *Campanula glomerata* 21:+, *Rubus idaeus* juv. 22:+, *Anthyllis vulneraria* 22:+, *Polygala vulgaris* 23:2, *Sedum rupestre* 23:+, *Saxifraga sponhemica* 23:r, *Hieracium cymosum* 24:+, *Melica uniflora* 25:+, *Thymus pulegioides* 25:r, *Dianthus carthusianorum* 26:1, *Rumex acetosella* 26:+, *Cornus mas* juv. 27:+, *Verbascum lychnitis* 27:+, *Pulsatilla grandis* 27:+, *Arabis glabra* 28:+, *Aconitum anthora* 28:+, *Polygonatum multiflorum* 29:+, *Sanguisorba minor* 29:+, *Buphthalmum salicifolium* 29:+, *Viburnum lantana* juv. 29:+, *Hieracium lachenalii* 29:+, *Daphne mezereum* juv. 29:+, *Galium verum* 30:+, *Lamium maculatum* 31:+, *Sisymbrium strictissimum* 31:+, *Prunus mahaleb* juv. 31:+, *Fallopia dumetorum* 31:+, *Jovibarba hirta* 31:r, *Arenaria serpyllifolia* 31:r, *Thymus glabrescens* 31:r, *Artemisia absinthium* 32:+, *Veronica prostrata* 32:+, *Poa badensis* 32:+, *Arenaria grandiflora* 32:+, *Minuartia setacea* 32:+, *Koeleria macrantha* 32:+, *Centaurea stoebe* 33:r, *Senecio integrifolius* 33:r.

TABLE 1A - HEADER DATA OF RELEVÉS (TABLE 1)

Relevé nr.	Area (m^2)	Altitude (m)	Aspect	Slope (°)	Cover (%) E_3	E_2	E_1	E_0	Date
1	100	490	N	20	70	30	30	25	20.5.1991
2	300	450	SE	25	75	20	40	10	25.8.1993
3	200	450	S	30	70	20	40	5	25.8.1993
4	300	450	S	30	65	35	40	10	25.8.1993
5	400	450	SE	30	80	15	25	10	25.8.1993
6	100	370	N	40	65	20	40	15	1.6.1993
7	250	410	N	30	70	20	30	15	1.6.1993
8	300	410	N	30	75	20	15	5	1.6.1993
9	200	440	SW	45	70	25	25	1	1.7.1995
10	250	440	W	45	85	10	25	5	1.7.1995
11	150	440	W	55	85	10	20	1	1.7.1995
12	150	440	W	45	70	20	25	2	1.7.1995
13	200	440	W	50	75	15	30	5	1.7.1995
14	300	280	NW	35	85	10	25	2	1.8.1992
15	250	250	N	40	70	20	60	7	10.9.1993
16	200	250	N	25	70	15	65	10	10.9.1993
17	300	250	NW	20	75	10	70	10	10.9.1993
18	200	260	SW	30	60	40	40	0	10.9.1993
19	200	260	SW	25	65	30	35	1	10.9.1993
20	?	?	W	33	70	30	80	100	?
21	200	300	WNW	40	60	15	70	15	30.8.1994
22	200	290	WNW	50	40	20	80	15	31.8.1994
23	100	240	NW	70	80	40	60	20	31.8.1994
24	100	290	NW	50	80	40	80	70	27.5.1993
25	100	290	NW	40	70	10	70	10	4.9.1994
26	50	270	E	80	80	10	70	50	31.7.1994
27	100	320	WSW	45	50	10	90	10	4.9.1992
28	80	350	WNW	50	60	50	60	20	3.8.1992
29	150	350	WNW	40	70	40	80	5	24.7.1992
30	100	320	WNW	70	60	70	60	20	5.9.1992
31	150	410	WNW	45	60	30	70	30	6.8.1994
32	28	420	N	40	60	0	65	20	6.8.1994

TABLE 2 - *TILIA*-DOMINATED CALCICOLOUS FORESTS IN CENTRAL EUROPE. NUMBERS STAY FOR CONSTANCY CLASSES (1 - 1-20 %, 2 - 21-40 %, 3 - 41-60 %, 4 - 61-80 %, 5 - 81-100 %). CAPITAL LETTERS REFER TO THE GROUPS DISCUSSED IN THE TEXT. SOURCES OF THE DATA ARE LISTED IN APPENDIX 2. TREE SPECIES ARE SET IN BOLD.

Tab. 2. *Tilia*-dominated calcicolous forests in Central Europe. Numbers stay for constancy classes (1 - 1-20 %, 2 - 21-40 %, 3 - 41-60 %, 4 - 61-80 %, 5 - 81-100 %). Capital letters refer to the groups discussed in the text. Sources of the data are listed in Appendix 2. Tree species are set in bold.

Group	AAAA	BBBBBBBBBBB	CCCCCCCCC	DD	D	EEEE	FFFF
Column nr.	1234	5 6 789012345678	901234567	89	0 1 2	3456	7890
Number of relevés	5564	4 0 907735204684	289225758	82	2 6 4	0000	1062
***Asperulo taurinae-Tilietum* (Switzerland)**							
Viburnum opulus	3544	. 1 .2.111....1.	1	..	. . .	....	....
Rubus caesius	3312	. . ...11.....	.....	..	. . .	....	....
Juglans regia	1113	. . ..	.....	..	. . .	....	....
Ilex aquifolium	235.	. 1	.....	..	. . .	....	....
Euonymus latifolia	221.	. . ..	.....	..	. . .	....	....
Polystichum aculeatum	12.2	. . 1.....	.....	..	. . .	....	....
Asperula taurina	44..	. . ..	.....	..	. . .	....	....
***Asperulo taurinae-Tilietum* & Community of Swiss Southern Alps**							
Veronica urticifolia	2424	4	.....	..	. . .	....	....
Luzula nivea	11.4	4	.....	..	. . .	....	....
Lilium bulbiferum ssp. *croceum*	11..	3	.....	..	. . .	....	....
Anthoxanthum odoratum	11..	?	.....	..	. . .	....	....
Community of Swiss Southern Alps							
Festuca heterophylla	11..	5 . 1....11.....	2...1..2.	..	. . 2	1...	....
Hieracium umbellatum	1...	4	.....	..	. . 2	....	....
Lembotropis nigricans	....	3	.....	..	3 . .	....	....
Trifolium medium	....	3	.....	..	. . .	....	..3.
Galium rubrum	....	3	.....	..	. . .	....	....
Chaerophyllum hirsutum	....	2	.....	..	. . .	....	....
Laserpitium halleri	....	2	.....	..	. . .	....	....
Potentilla pusilla	....	2	.....	..	. . .	....	....
Pteridium aquilinum	....	2	.....	..	. . .	....	....
Silene dioica	....	2	.....	..	. . .	....	....
Vicia incana	....	2	.....	..	. . .	....	....
Populus tremula	....	2	.....	..	. . .	....	....
***Seslerio-Tilietum platyphylli* (France, Côte)**							
Rhamnus alpinus	....	. 4	.....	..	. . .	....	....
Prunus mahaleb	1...	. 3 11...111....	1	..	. . 1	...1	....
***Aceri-Tilietum* (Germany)**							
Scrophularia nodosa	....	. . ..2121..2.1.	2.....	..	. . .	1.1.	....
Carex ornithopoda	....	. . ..111111....	.....	..	. . .	....	....
Centaurea montana	....	. . ...21111..1.	.....	..	. 1 .	....	....
Dentaria pentaphyllos	....	. . ...111.3....	.....	..	. . .	....	....
Epipactis atrorubens	....	. . ..11..213	.....	..	. . .	....	....
Thlaspi montanum	....	. . ..111....	.....	..	1 . .	....	....
***Aceri-Carpinetum aconitetosum vulpariae* (Czech Republic, western Slovakia)**							
Pulmonaria officinalis agg.	....	. . ...3111.....	555355343	.1	. . .	2132	..1.
Asarum europaeum	....	. . 12.332112.13	544444152	.1	. . 2	21.3	..13
Viola mirabilis	11..	. . .3.32222....	5453.4352	..	. . .	1.13	....
Aconitum vulparia	11..	. . ...11.....	132.21311	..	. . .	1..1	....
Lathyrus niger	....	. . ...1.1.....	11.11..21	..	. . .	....	....
Ranunculus lanuginosus	....	. . ...11.....2	41.2111..	..	. . .	....	....
Fallopia convolvulus	....	2 . .....1....	.112.1.32	.1	. . 3	....	....
Hieracium lachenalii	....	. . ..	44.3.11..	..	1 . .	....	....
Aceri-Carpinetum aconitetosum vulpariae* & *Seslerio albicantis-Tilietum cordatae							
Fragaria moschata	....	. . ..	43.23...2	22	1 . .	....	....
Melampyrum nemorosum	....	. . ..	.11.2...1	42	1 . .	....	....
Arabis pauciflora	....	. . ..	....13...	23	2 . .	....	....
***Seslerio albicantis-Tilietum cordatae* (Czech Republic, northern Austria)**							
Bupleurum falcatum	....	. . ..11....	.2...2...	44	4 . 3	....	....
Anthericum ramosum	111.	. 1 21....2.....	..3.....	33	5 . 2	1...	....
Inula conyza	....	. . ..1....	.....1..	13	2 . .	.1..	....

Stachys recta	.... 21 2 . . ..
Galium pusillum agg.	.... 4. 2 . . ..
Seseli libanotis	....1..... ..... 3. 1 . . ..
Galium glaucum	.... .3 3 . . ..
Festuca ovina	....2 ..... .2 3 . . ..
Geranium sanguineum	.1.. . . 1..... ..... .2 2 . . ..
Scabiosa ochroleuca	.... .1 3 . . ..
Aster amellus	.... .1 2 . . ..
Seseli osseum	.... .1 2 . . ..
Helianthemum ovatum	.... .1 1 . . ..
Veronica teucrium	.... .3 . . . .

***Seslerio albicantis-Tilietum cordatae euphorbietosum cyparissiae* (southern Moravia, northern Austria)**

Acinos arvensis	.... 3 . . ..
Potentilla arenaria	...., ... 3 . . ..
Allium flavum	.... 2 . . ..
Allium montanum	.... 2 . . ..
Thymus praecox	.... 2 . . ..

***Tilio-Sorbetum* (Hungary, Bükk)**

Cimicifuga europaea	....3... .. . 5 . ...
Clematis alpina	.... 5 . ...
Saxifraga paniculata	.... 11 1 5 2 ....
Valeriana tripteris	11.3 . . ..2...1..... .....2 .. . 5 . ..1. ....
Arabis alpina	.... 4 . ...
Scabiosa columbaria ssp. *pseudobanatica*	.... 4 . ..1. ....

***Seslerio heufleranae-Quercetum petraeae* (Slovakia, Slovakian Karst)**

Poa stiriaca	.... 5 ....
Platanthera bifolia	1... . . .. 3 ....
Hypericum maculatum	.... 3 ....
Avenochloa pubescens	.... 2 ....
Bothriochloa ischaemum	.... 2 ....
Carex tomentosa	.... 2 ....
Poa compressa	.... 2 ....
Senecio capitatus	.... 2 ....
Vicia tetrasperma	.... 2 ....

Tilio-Sorbetum* & *Seslerio heufleranae-Quercetum petraeae

Festuca altissima	11.. . . .. 2.....1.. .. . 4 3 .... ..1.

***Mercuriali-Tilietum* (Hungary)**

Corydalis solida	.... 2225 .3..
Corydalis cava	....1..... 1..... .. . . . 1325 ....
Adoxa moschatellina	1... . . ...1..... .... 2.13 ....
Galanthus nivalis	.... .124 ....
Lathraea squamaria	....1..... .... .111 ....
Fraxinus ornus	.... 22.. ....
Scutellaria columnae	.... 21.. ....
Geranium lucidum	.... . . 1..... .... 2..4 1...
Veronica hederifolia agg.	.... 1..5 ....
Gagea minima	....14 ....

***Tilio-Fraxinetum* (Hungary, Romania)**

Hesperis matronalis agg.	....1. 41.3
Scutellaria altissima	.... 114.
Helleborus purpurascens	.... .25.
Hypericum perforatum	....1.....2 ..... .1 1 . . . ..1. ..43
Melampyrum bihariense	13
Viola tricolor	.... 1 . . .... 4...
Silene heuffelii	....5.
Smyrnium perfoliatum	.... 1... ..5.
Polystichum setiferum	....4.
Verbascum lanatum	....4.
Rhamnus saxatilis ssp. *tinctorius*	5
Spiraea chamaedryfolia	5

Differential species of western communities

Lonicera xylosteum	5555 4 4 554344335.24 .4.114322 33 1 5 . .... 4...
Quercus robur	2233 . . ...21112..12 .1.44.11. .1 1 . . ..
Rubus fruticosus agg.	3453 3 1 11.11111.... ..1.2.... .1 . . . .
Epipactis helleborine	2312 3 1 .21111.1.... .....2 21 . . 2 ....
Prenanthes purpurea	2315 3 . .231.11..... 1...1...1 .. . .1. ....
Picea abies	23.3 2 . ...2111..1.. .1...23.. 4. 1 . . ..
Pimpinella major	22.. 4 . ...11121.... .....3332 2. . 5 . ...

Oxalis acetosella	12.2	2	.	...11.1.2...	32...23.1	1.	.	.	.	....	....
Vicia sepium	12.2	.	.	.2.22222...2	3.1.2..1.	..	.	.	.	....	....
Taxus baccata	3243	.	.	12..1...3.2.	.....21..	12	.	.	.	....	....
Rosa arvensis	4555	.	2	33.12111....	....	..	.	.	.	....	....
Phyteuma spicatum	332.	.	.	.1.3111.2..4	...33....	..	.	.	.	....	....
Carex montana	2223	.	.	.1.111.1....	....2....	..	1	.	.	....	....
Prunus spinosa	1112	2	.	...11111....	....	..	.	.	.	....	....
Galeopsis tetrahit	1...	4	.	31.11112..1.	....	..	.	.	.	....	....
Carex flacca	122.	.	.	.212111.....	....	..	.	.	.	....	....
Coronilla emerus	2354	4	.	44....1.....	....	..	.	.	.	....	....
Tamus communis	235.	.	.	.431.11.....	....	..	.	.	.	1...	....
Cyclamen purpurascens	331.	2	.	211.........	....	..	2	.	.	....	....
Rubus saxatilis	12.2	.	.	...21112....	....	..	.	.	.	....	....
Lonicera alpigena	11..	.	.	..321121....	....	..	.	.	.	....	....
Helleborus foetidus	..5.	.	.	11.13222....	....	..	.	.	.	....	....
Knautia dipsacifolia	12..	3	.	...1112.....	....	..	.	.	.	....	....
Hedera helix	.35.	.	.	..1..113...3	....	..	.	.	.	....	....
Aruncus dioicus	2213	.	.	..5.........	2........	..	.	.	.	....	....
Paris quadrifolia	33.2	.	.	..21........	....	..	.	.	.	....	....
Primula elatior	1114	.	.	...21.......	....	..	.	.	.	....	....
Carex sylvatica	22..	.	.	...211......	....	..	.	.	.	....	....
Primula vulgaris	111.	.	.	13..........	....	..	.	.	.	....	..1.
Molinia caerulea agg.	11..	2	.	...1........	....	..	.	.	.	....	....
Betonica officinalis	11..	2	1	....	....	..	.	.	.	....	....
Asplenium adianthum-nigrum	1...	2	.	11..........	....	..	.	.	.	....	....
Teucrium scorodonia	.1..	.	2	31..........	....	..	.	.	.	....	....
Acer opalus	..5.	.	2	44..........	....	..	.	.	.	....	....
Differential species of eastern communities											
Alliaria petiolata	....	.	.	...13111...3	433114323	.1	1	.	3	4125	4.4.
Sedum maximum	.11.	3	.	3......1....	.13..2212	23	3	5	4	4254	5.55
Dactylis glomerata agg.	....	2	.	...121.1...4	52323.15.	.2	2	.	3	3424	545.
Cornus mas	..5.	.	3	11..........	.43313..1	23	2	.	5	45.5	5553
Stellaria holostea	....	.	.	...111......	5445533..	.3	.	.	4	3234	5345
Chelidonium majus	....	.	.	...111.1....	.1.1123.3	.1	1	.	2	3323	5.2.
Cardaminopsis arenosa	....	.	.	.....11.....	.22...2.2	22	2	5	4	3323	..43
Cystopteris fragilis	1...	2	.	1.....1.....	.1...24.2	2.	.	5	4	2143	4...
Arabis turrita	....	.	.	21..........	3	..	2	5	3	3314	5313
Euonymus verrucosa	....	.	.	....	.....331.	31	3	4	3	34.5	...5
Dentaria bulbifera	1...	.	.	....	1...1.1.4	..	.	.	3	2111	..1.
Galium schultesii	....	.	.	....	4	..	.	5	5	1143	5455
Glechoma hirsuta	....	.	.	....	23	..	.	.	3	3213	535.
Myosotis sylvatica	....	.	.	....	.11.123..	21	.	.	2	....	...3
Euphorbia cyparissias	..1.	.	.	....	....	.2	4	.	3	.32.	..4.
Viola odorata	....	.	.	2	......1..	..	.	.	.	1125	..4.
Anthriscus sylvestris	....	.	.	....	....3....	1.	1	.	.	1.12	..4.
Aconitum anthora	....	.	.	....	....	..	1	.	3	..11	54.3
Waldsteinia geoides	....	.	.	....	....	..	.	.	3	..33	5553
Fallopia dumetorum	....	.	.	3...........	....	..	1	.	.	1.3.	5.5.
Anemone ranunculoides	....	.	.	...1........	....	..	.	.	.	1325	.4..
Erysimum odoratum	....	.	.	.......1....	....	.2	1	.	.	.1..	4.1.
Omphalodes scorpioides	....	.	.	....	21...12..	..	.	.	.	..11	....
Coronilla varia	....	.	.	....	..2.1....	.3	2	.	.	1...	..3.
Isopyrum thalictroides	....	.	.	....	.....21..	..	.	.	2	1.23	....
Oryzopsis virescens	....	.	.	....	....	..	.	.	2	13.1	21..
Euphorbia polychroma	....	.	.	....	....	2.	1	.	.	1...	1.2.
Parietaria officinalis	....	.	.	....	2	..	.	.	.	21..	..1.
Sesleria heuflerana	....	.	.	....	....	..	.	5	3	....	.1.5
Geranium phaeum	....	.	.	....	....	..	.	.	3	1.1.	...3
Cruciata glabra	....	.	.	....	....	..	.	.	3	....	4..5
Polygonatum latifolium	....	.	.	....	....	..	.	.	2	1..3	....
Chamaecytisus hirsutus	....	.	.	....	....	..	.	.	2	..1.	...5
Viola suavis	....	.	.	....	....	..	.	.	.	3...	44..
Quercus cerris	....	.	.	....	....	..	.	.	.	2...	4.3.
Spiraea media	....	.	.	....	....	..	.	.	.	..1.	23..
Fagetalia											
Fraxinus excelsior	5555	3	4	55252455.425	145325444	42	.	.	3	4325	5553
Mercurialis perennis	5553	.	3	554444354125	554353522	24	.	4	4	4544	.225
Acer pseudoplatanus	3314	2	.	115554555554	354435533	21	.	4	2	2112	.313
Tilia platyphyllos *)	3353	.	5	555555555555	35134434.	.5	4	5	5	4535	543.
Campanula rapunculoides	115.	4	.	221211212115	542343344	43	1	5	5	112.	534.
Corylus avellana	5555	5	5	555545553545	.554353.5	45	3	4	.	3.31	431.
Geranium robertianum	121.	2	.	..3232242.15	343325435	21	1	5	3	3254	544.
Mycelis muralis	1.23	2	1	431233334514	343.334.5	42	.	4	5	3452	..43
Acer platanoides	4423	.	1	22233333.114	324334213	33	.	.	3	3114	.4..
Poa nemoralis	1314	4	.	..323212..15	53.344351	33	3	5	3	325.	5425
Ulmus glabra	5423	.	.	233322222.15	23121332.	.1	.	.	2	2112	..1.
Galium odoratum	4453	.	.	33323221.122	521343554	12	.	.	2	1132	..2.
Hieracium sylvaticum	2343	5	1	224221114.22	2141311.2	43	3	5	4	1.2.	....
Lathyrus vernus	2254	3	.	1523132.2...	445542543	23	1	5	5	1122	..1.

Lamiastrum galeobdolon agg.	5553	2	2	33255323..22	545335534	41	.	.	.	22.3	...3
Carex digitata	5552	5	2	44.211214.12	1442343.1	54	3	4	4	1..1	....
Fagus sylvatica	442.	.	1	14.332213123	.231423.5	43	1	5	3	.431	..2.
Carpinus betulus	1.4.	.	1	1.212211..12	555452353	14	3	.	3	3123	4.2.
Convallaria majalis	1..4	.	3	333333234553	123232111	42	1	.	4	1.1.	4...
Acer campestre	455.	.	2	34133222..15	31231.233	11	.	.	2	33.4	5.4.
Campanula trachelium	45.5	4	.	23.43223.1.4	445334355	.3	1	.	3	3.21	...5
Melica nutans	23.4	.	.	422322333.1.	454355431	33	1	4	4	..2.	...3
Quercus petraea **)	21.5	3	3	45111121....	21.2...41	25	1	.	5	2122	52.5
Hepatica nobilis	4425	3	1	44.1111.55.4	455355452	14	1	.	.	....	...5
Polygonatum multiflorum	3324	2	.	233411..3..2	221.14241	..	1	.	.	2115	..43
Fragaria vesca	3454	5	.	32311111.1.4	..4...11.	31	3	5	4	1.1.	4.1.
Geum urbanum	122.	.	.	1..12111...4	.22312251	..	1	.	3	3213	444.
Campanula persicifolia	....	2	.	..111111...5	322312213	33	3	5	4	231.	..45
Hedera helix	555.	.	4	55232322.244	.3212..22	..	.	.	3	23.5	..1.
Cornus sanguinea	4554	.	3	342334243223	.3.13..53	15	.	.	.	1..2	....
Brachypodium sylvaticum	455.	3	.	12.3221...12	2....2232	1.	.	.	3	23..	4323
Tilia cordata ***)	5555	5	.	...12111..1.	.142...55	52	3	.	3	122.	...3
Viola reichenbachiana	555.	4	1	2112221....4	41.15..41	.1	.	.	2	1.1.	..1.
Bromus ramosus agg.	4552	.	.	22132211..14	4.22112.2	2.	.	.	3	...4	....
Sambucus nigra	12.3	2	.	11.121123..2	.2.1141.4	11	.	.	.	1...	..1.
Crataegus laevigata	345.	3	.	23.31111..13	.1.1...21	.1	.	.	3	1..1	....
Galium sylvaticum	32..	.	.	.2.32222...2	44535451.	32	1	.	.	.1..	....
Crataegus monogyna	3444	.	.	24.22212....	..2..2131	..	.	.	.	24.1	5.53
Actaea spicata	22.5	.	.	.1.221..5.12	1221244.1	2.	.	4	2	....	....
Agropyron caninum	.1..	.	.	...11112..14	24.3.111.	12	1	.	2	1..1	..2.
Dryopteris filix-mas	22.3	2	.	3.2231..2.1.	3....33.1	2.	.	.	3	1.4.	...3
Lilium martagon	...3	.	.	...3211.4...	24..4112.	12	.	.	2	1113	...3
Melica uniflora	....	.	.	42.21111..14	53	.1	.	.	3	.435	545.
Lamium maculatum	....	.	.	...11111....	34.523351	..	1	.	.	3.14	.35.
Rhamnus catharticus	2314	2	2	22...111..1.	......1.1	11	.	.	.	....	4.1.
Clinopodium vulgare	11..	5	.	2....122....	2.2.1211.	1.	1	.	3	1...	4...
Ligustrum vulgare	3453	2	.	53.11221....	1	2.	.	.	.	11..	..4.
Euonymus europaea	3354	.	.	33.211......	.221.2...	.1	1	.	.	1..2	....
Senecio nemorensis agg.	....	.	.	...221112.12	131..44.4	21	.	.	.	..1.	....
Moehringia trinervia	1...	.	.	41111.......	11..1.3..	..	1	.	2	222.	..2.
Euphorbia amygdaloides	..4.	.	2	11.1111.....	......1.1	..	.	.	3	1412	..4.
Anemone nemorosa	1...	.	1	11.4211.32.2	3..33....	..	.	.	.	....	...3
Ajuga reptans	111.	.	.	...11.......	..1.131.1	..	.	.	2	141.	....
Hordelymus europaeus	....	.	.	11.1.1....12	11.21..1.	..	.	.	.	1.12	....
Arum maculatum agg.	11..	.	.	...421.....4	3......11	..	.	.	.	21.4	..4.
Epilobium montanum	....	.	.	..2111......	...1.11.2	1.	1	.	.	113.	....
Sanicula europaea	2212	.	.	...1111.....	1..11...1	..	.	.	.	....	....
Lapsana communis	....	.	.	....1.11...2	213.1.141	..	.	.	.	3...	....
Milium effusum	1...	.	.	2..131.....2	31..2..2.	..	.	.	.	....	..1.
Abies alba	1223	.	.	22.5........	2...1....	..	1	.	.	....	....
Hypericum montanum	1112	3	.	....11......	2...1....	..	.	.	.	..1.	....
Neottia nidus-avis	1...	.	.	.2111.1.....	2...1....	..	.	.	2	1...	....
Euphorbia dulcis	..2.	.	.	.3.2111.....	..11.11..	..	.	.	.	....	....
Salvia glutinosa	34.2	5	.	......1.....	3	..	.	.	2	1.1.	....
Daphne mezereum	11..	.	.	11......3...	......1..	..	1	5	.	1...	....
Impatiens noli-tangere	1...	.	.	...12.......	.2.1113..	..	.	.	.	..1.	....
Ribes uva-crispa	....	.	.	...121.....3	.2...31.2	..	.	.	.	.1..	....
Stachys sylvatica	22..	.	.	...13.......	1...1....	..	.	.	.	1...	..1.
Staphylea pinnata	.1..	.	.	.....1......	2233	..	.	.	.	2..5	....
Cardamine impatiens	....	.	.	...11.1.....	3....23..	..	.	.	3	1...	....
Phyllitis scolopendrium	11..	.	1	1...........	....	..	.	.	3	....	..13
Bupleurum longifolium	....	.	.	.....111...2	.1.22....	..	.	.	.	....	....
Astragalus glycyphyllos	....	.	.	.....1.....2	1.1.1....	..	.	.	2	....	..1.
Galeopsis pubescens	....	.	.	....	121.1....	..	.	.	2	11..	....
Carex alba	11.2	.	.	.....11.....	....	..	.	.	.	1...	....
Viola riviniana	11..	3	.	....	.12......	..	.	.	3	....	....
Cephalanthera damasonium	11..	.	.	.....1......	....2..1.	..	.	.	3	....	....
Festuca gigantea	1...	.	.	...11.......	....	..	.	.	.	1.1.	..2.
Frangula alnus	.1.2	.	.	...1......1.	.....2...	..	.	.	.	....	..1.
Circaea lutetiana	....	.	.	...11.......	.1....1.1	..	.	.	.	1...	....
Dentaria enneaphyllos	....	.	.	....	11..1.3..	..	.	.	.	1..1	....
Malus sylvestris	112.	.	.	......1.....	....	1.	.	.	.	....	....
Ulmus minor	1.1.	.	.	....	..4....2.	..	.	.	.	1...	....
Daphne laureola	.15.	.	2	....	....	..	.	.	.	13..	....
Athyrium filix-femina	.1..	.	.	...11...3...	....	..	.	.	.	..1.	....
Vicia sylvatica	....	.	.	....1.1.....	2..2.....	..	.	.	.	.4..	....
Quercetalia pubescenti-petraeae											
Polygonatum odoratum	1115	4	3	22...111...4	22421....	23	2	.	2	211.	4..3
Vincetoxicum hirundinaria	22.2	4	2	1155552	.14..3313	53	4	.	4	1...	5.4.
***Sorbus aria* agg.**	3354	4	3	543112433.1.	1	43	3	5	5	....	...3
Viburnum lantana	3455	4	4	43322231....	2	..	1	.	3	21.4	4.4.
Galium album	11.2	3	.	22221121....	......1..	.1	2	4	3	112.	5..3
Primula veris	....	.	.	11.11121...5	.4123.1..	23	3	.	2	151.	.4.5
Melittis melissophyllum	..1.	.	5	34.11111....	121.2.1.2	.1	1	.	3	11..	...3
Viola hirta	2342	.	.	23.21111...4	.34.31.2.	..	1	.	3	1...	....

Tanacetum corymbosum	.... 3 . ...21221.... .3335..1. .4 3 . 3 111. ...5
Sorbus torminalis	.... . . 13.1111..... .... .2 1 . 1 11.1 5.2.
Origanum vulgare	11.. . . ...11132.... .... 21 3 . . 1... 4..3
Brachypodium pinnatum	...2 2 . ...11111..1. .... .2 3 . 3 .... 5...
Teucrium chamaedrys	.... . 2 21...13..... .... 22 3 . 2 .1.. 5...
Quercus pubescens ****)	.15. 2 3 .....11..... .... 11.1 ...3
Silene nutans	..12 3 . ...2..... 12 1 . 2 .1.. ...3
Carex humilis	11.. . . ..1..... .... .1 1 . . ..
Buglossoides purpurocaerulea	....111..... ....2 .. . . . 2... ....
Other species	
Asplenium trichomanes	13.3 4 1 522..11..... .1...54.2 42 3 5 4 3314 ...5
Veronica chamaedrys agg.	1... . . 21.1.111...3 .11.2..1. 21 3 4 4 22.3 4.45
Solidago virgaurea	4555 5 1 23431221.115 ....3 .. 2 5 2 ..1. ....
Clematis vitalba	2222 . 2 .21223222423 ....3 .. . . . 22.. ..4.
Berberis vulgaris	1212 2 . 31.1.11..... ..2..12.. 41 2 . 3 11.. ...5
Galium aparine	.... . . 31.1211..... 31.11222. 1. . . 2 1.23 5.4.
Aegopodium podagraria	23.3 . . .1.411..2... 445421211 .. . . . 1.2. ....
Digitalis grandiflora	111. 3 . ..1111..... .1.....2 23 2 5 4 ..1. 4.15
Urtica dioica	....12111.... 22..14335 2. . . 2 3.4. ..1.
Prunus avium	2354 2 . 121121.1..1. .... 11.1 ....
Heracleum sphondylium	11.2 . . ...111..... 12..2.222 .. . . 3 111. ....
Taraxacum officinale agg.	.... . . 31.11111.2.5 ..2..... .1 1 . 2 .... ..1.
Sorbus aucuparia	1215 . . ...111.1..2. .... 21 . 5 3 ....
Carex muricata agg.	.... . . 11.1.1.....4 .1..1.11. .. . . 2 1... 5.4.
Maianthemum bifolium	1114 2 . ...1....2... .22.111.. .. . .
Valeriana officinalis agg.	..2. . . ...11111.... .... .2 1 . . 12.. ..25
Chaerophyllum temulum	.... . . 1..11.....5 .53.111.. .. . . 2 4... 4...
Asplenium ruta-muraria	11.. . . 11....1..... .... 21 2 . 3 .12. ....
Sesleria albicans	1... . 5 ...1..4..132 ......1.. 55 5 . . ..
Polypodium vulgare	.123 3 . ...1 21 . 5 5 .2.3 ....
Silene vulgaris	....11112.... .... 11 2 . 3 1.1. ....
Laserpitium latifolium	1..2 . 2 ......2...1. ....4 .1 . 5 3 .1.. ....
Rosa canina agg.	.... . 1 1.....1..1.. ....1. .2 . . . 122. 4...
Ranunculus auricomus agg.	....221.....4 3.131..1. .. . . 2 ....
Viola collina	11.. . . ...11111.... .... 23 . . . .
Calamagrostis varia	111. 4 . ...1..1.3... .... 5 . ...
Campanula rotundifolia agg.	.... 2 . ...21.... .... .2 2 . 3 .11. ....
Ribes alpinum	.... . 2 5..... 21.11.1.. .1 . . . .
Aethusa cynapium	....111.1...3 ....1.1.. .. . . . 1... ....
Arabis hirsuta	.... 3 . ..... .1...2... .4 1 . 3 1... ....
Sambucus racemosa	....111112... ......2.. .. . .
Moehringia muscosa	11.. . . 31..... .... 11.. ....
Gymnocarpium robertianum	.... . 1 ....25.1. ....1 2. . . . .
Hypericum hirsutum	11.. . . ....1..... ....3. 3
Polygala vulgaris	.... . 1 ....12.. .. 1 . . 2... ....
Sedum album	.... . . 2....1..... ......1.. .1 1 . . ..
Impatiens parviflora	....11..... .4.....1. .. 1 . . ..
Torilis japonica	....1...2 ..3....2. .. . .1.

*) Column 31: *Tilia platyphyllos* = *T. platyphyllos* et *T. cordata*
**) Column 5: *Quercus petraea* = *Q. petraea* x *Q. pubescens*
Columns 7, 8: *Quercus petraea* = *Q. petraea*, *Q. pubescens* et *Q. robur*
***) Column 27: *Tilia cordata* = *T. cordata* et *T. platyphyllos*
****) Column 3: *Quercus pubescens* = *Q. pubescens* x *Q. robur*