This paper presents the phytosociological description of a drained swamp community, *Veratro albi-Fraxinetum angustifoliae*, so far found only in the Nyírség at Nyírábrány “Kis-kőrises”, “Mogyorósi-erdő”; Vámospércs “Jónásrész-Kőrises”; and Vámospércs “Jónásrész-Buzita”. The habitat of the community is transitional between that of alder swamps (*Fraxino pannonicae-Alnetum glutinosae*), and hardwood riparian forests (*Fraxino pannonicae-Ulmetum*). The community is characterised by high proportions of character species of Alnion glutinosae and Molinion coerulei as well as Quercetea pubescentis-petraeae s. l., whereas character species of the order Fagetalia are almost completely absent. It hosts several rare, often threatened species, such as *Angelica palustris*, *Ophioglossum vulgatum*, *Trollius europaeus* and *Veratrum album*.

Key words: ash swamp, Great Hungarian Plain, Natura 2000, nature reserve, syntaxonomy

INTRODUCTION

Hardwood riparian forests have been the subject of our long-term research on the distribution, composition and geographical variation of the forest vegetation in Hungary. Hardwood riparian forests still occur in most lowland areas of Hungary under different environmental conditions and thus are particularly suitable for studying phytosociological differentiation and biogeographical relationships in the forest vegetation within the Carpathian Basin. During our work in the Nyírség, an extensive area in the northeastern part of Hungary covered with eolic sand, we found several *Fraxinus angustifolia* dominated forest stands that seemed to be different from all known forest communities described previously in the country (Figs 1–2). No similar forest community is known to exist in the European vegetation either (Braun-Blanquet 1964, Ellenberg 1986, Horvat 1938, Horvat *et al.* 1974, Mucina *et al.* 1993, Oberdorfer 1992a, b, Rodwell *et al.* 2002, Willner and Grabherr 2007a, b).

Because their species composition appeared to be substantially different from that of the *Fraxino pannonicae-Ulmetum* Soó in Aszód 1935 corr. Soó
1963, a community once widely distributed in similarly moist habitats across the country, and Fraxino pannonicae-Alnetum Soó et Járai-Komlódi in Járai-Komlódi 1958, we described it as a novel association under the name Veratro albi-Fraxinetum angustifoliae Kevey et Papp L. (Kevey 2008).

Unfortunately, this association has not been described in more detail, nor has a synoptic table of it been published since then. Here we are going to fill this gap by providing a detailed description of the community based on our sample material of ten relevés. Our primary goal is to substantiate the split of this new association from the rest of the hardwood riparian forests found in Hungary.

MATERIAL AND METHODS

Research area

The studied Fraxinus angustifolia dominated stands were found in four different forest areas in the Nyírség: the Mogyorósi-erdő and Kis-kőrises near the town of Nyírábrány, and the Jónásrész-Kőrises and Jónásrész-Buzita near the village of Nyíracsád. The stands were all found along the edge of local

![Fig. 1. Veratro albi-Fraxinetum angustifoliae: Vámospércs “Jónásrész” with Veratrum album in the foreground (photo: L. Papp)](image-url)

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depressions where the habitat is characterised by high groundwater levels, which rises above the ground surface only in very wet periods. They either grow at the fringe of genuine alder swamps (*Fraxino pannonicae-Alnetum*) in the deepest parts of local depressions, or form the transition zone between these swamps and oak-ash-elm forests (*Fraxino pannonicae-Ulmetum*) growing on higher ground (Fig. 3). Since the ground is normally not covered with water throughout most of the vegetative period in their habitats, the soil contains only small amounts of peat that is generally decaying.

The three studied forest areas are all parts of the Natura 2000 network, and are also protected by national law. The Jónásrész “Kőrises” and “Buzita”, and “Kis-kőrises” are state reserves, whereas the “Mogyorósi-erdő” is under strict protection.

**Methods**

Our sampling procedure followed the traditional quadrate method of the Zürich-Montpellier phytosociological school (Becking 1957, Braun-Blanquet 1964). Sample plots were designated visually by selecting the parts of a stand that seemed to be the most homogeneous in habitat characteristics,

*Fig. 2. Veratro albi-Fraxinetum angustifoliae: Vámospércs “Jónásrész” with Trollius europaeus in the herb layer (photo: L. Papp)*
vegetation structure and species composition, and showed no signs of human impact (including forest management). Because the traditionally used 400 m$^2$ plot size does not satisfy the requirement for minimal area (see Du Rietz 1921), our sample plots were 1600 m$^2$ in size except for one (1200 m$^2$). This size suffices the requirement of representativity in temperate deciduous forests (Kevey 2008).

Because forests in similarly mesic habitats tend to exhibit large phenological changes during the vegetative period, we sampled each stand twice (spring and summer) using the same plots. During sampling, we recorded all species within the sample quadrate and estimated their projected cover. We also estimated the height of each vegetation layer, and the trunk diameter of trees.

The raw data were compiled and arranged in a synoptic table by the NS software program (Kevey and Hirmann 2002), which also was used to calculate constancy values of each species, and proportions of species characteristic of a particular syntaxon. To assess the syntaxonomic relationship of the studied stands, we compared them to a representative material of the spatially adjacent Fraxino pannonicae-Alnetum and Fraxino pannonicae-Ulmetum, and all previously described communities growing in similar habitats in Hungary: Ophioglosso-Betuletum pubescentis (Vértesalja: Riezing and Szollát 2008–2009: 6 relevés); Molinio-Alnetum glutinosae (Tengelici-homokvidék: Kevey 2008: 20 relevés); Molinio-Salicetum cinereae (Szigetköz: Kevey 2008: 25 relevés). In doing so, we performed pairwise comparisons between sample sets and deter
mined the set of differential species (species that differed in their constancy value by at least two steps) and the proportions of character species. We also carried out binary cluster and principal coordinates analyses (PCoA) with the help of the Syntax 2000 package (Podani 2001). The method of grouping in the cluster analyses was complete link, and the similarity coefficient in both types of analyses was that of Baroni-Urbani and Buser.

The names of plants and syntaxonomic categories follow the nomenclature of Király (2009) and that of Borhidi and Kevey (1996), Borhidi et al. (2012), and Kevey (2008), respectively. Designation of species as character species of phytosociological taxa is primarily adopted from Soó (1964, 1966, 1968, 1970, 1973, 1980) with some modifications based on more recent literature (see Borhidi 1993, 1995, Horváth et al. 1995) and our own research experience (Kevey ined.).

The order of syntaxa in the synoptic and statistical tables follows the modified syntaxonomic system of Soó (1980) according to the suggestions and results of Borhidi et al. (2012), Kevey (2008), Mucina et al. (1993) and Oberdorfer (1992a, b).

RESULTS

Physiognomy and structure

In the studied stands, the forest canopy was structured into two distinct layers. The upper layer was situated at about 20–28 m height and was rather dense with high (60–80%) projected cover. The most abundant (A–D: 3–4) tree species in this layer were *Fraxinus angustifolia* subsp. *danubialis* and *Populus alba*. They were also constant species across the samples.

The lower canopy layer was at the height of 12–20 m. The projected cover was rather variable among samples. It was made up of mostly tree-sized shrubs and young individuals of trees. The most abundant species in this layer was *Fraxinus angustifolia* subsp. *danubialis*.

Shrubs in the samples were 1.5–3.5 m tall, and formed a moderately dense layer with 25–70% cover value. It was composed of *Cornus sanguinea*, *Crataegus monogyna*, *Frangula alnus*, *Fraxinus angustifolia* subsp. *danubialis*, and *Ligustrum vulgare*. Only *Cornus sanguinea* and *Ligustrum vulgare* had rather high cover values. The layer of saplings was greatly variable in projected cover (1–50%).

All samples had an apparent herbaceous layer, which greatly varied in cover (35–85%). The most frequent species include *Angelica sylvestris*, *Brachypodium sylvaticum*, *Cucubalus baccifer*, *Filipendula ulmaria*, *Geranium palustre*, *Listera ovata*, *Lychnis flos-cuculi*, *Lysimachia nummularia*, *Moehringia trinervia*, *Poa trivialis*, *Scrophularia nodosa*, *Valeriana officinalis*, *Veratrum album*. Only two species (*Brachypodium sylvaticum* and *Convallaria majalis*) were locally abundant at places (Table 1).
Table 1

Veratro albi-Fraxinetum angustifoliae

|                | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | A–D | K  | % |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|
| 1. Querco-Fagea|     |     |     |     |     |     |     |     |     |     |     |    |    |
| 1.1. Salicetea purpureae|     |     |     |     |     |     |     |     |     |     |     |    |    |
| 1.1.1. Salicetalia purpureae|     |     |     |     |     |     |     |     |     |     |     |    |    |
| 1.1.1.1. Salicion albae|     |     |     |     |     |     |     |     |     |     |     |    |    |
| Cucubalus baccifer (Cal,Ulm) | C   | +   | +   | −   | −   | +   | +   | +   | +   | −   | +   | IV | 70 |
| Salix fragilis (Ai,Cal) | A1  | +   | −   | −   | −   | 2   | −   | −   | −   | −   | 1   | +   | +2  | 40 |
|                      | A2  | −   | −   | −   | 1   | −   | −   | −   | −   | −   | −   | 1   | I   | 10 |
|                      | S   | +   | −   | −   | −   | −   | 2   | −   | −   | −   | 1   | +   | +2  | 40 |
| Humulus lupulus (Cal,Ate,Ai) | B1  | −   | −   | −   | −   | +   | −   | −   | −   | −   | −   | −   | +   | I   | 10 |
|                      | C   | −   | −   | −   | −   | −   | −   | 2   | −   | −   | −   | +   | +   | II  | 30 |
|                      | S   | −   | −   | −   | −   | −   | −   | −   | 2   | −   | −   | +   | +   | II  | 30 |
| 1.2. Alnetea glutinosae|     |     |     |     |     |     |     |     |     |     |     |     |    |    |
| 1.2.1. Alnetalia glutinosae|     |     |     |     |     |     |     |     |     |     |     |     |    |    |
| Betula pubescens (Qr,PQ) | A2  | −   | −   | −   | −   | +   | −   | −   | −   | −   | −   | −   | +   | I   | 10 |
| 1.2.1.1. Alnion glutinosae|     |     |     |     |     |     |     |     |     |     |     |     |    |    |
| Angelica palustris | C   | −   | −   | −   | −   | +   | +   | +   | −   | −   | +   | II  | 40 |
| Calamagrostis canescens (Pte) | C   | −   | −   | −   | −   | −   | −   | −   | −   | −   | −   | +   | I   | 10 |
| 1.3. Querco-Fagetea|     |     |     |     |     |     |     |     |     |     |     |     |    |    |
| Brachypodium sylvaticum (Qpp) | C   | 3   | 3   | 5   | 2   | 3   | 2   | 4   | 2   | 3   | 3   | 2–5 | V   | 100 |
### Table 1 (continued)

| Species                          | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | A–D | K | %  |
|----------------------------------|----|----|----|----|----|----|----|----|----|----|-----|---|----|
| **Cornus sanguinea (Qpp)**       | B1 | 2  | 1  | 2  | 3  | 3  | 2  | 3  | 3  | 2  | 1–3 | V | 100|
|                                 | B2 | +  | +  | 1  | 2  | +  | 2  | +  | 1  | +  | +   | +2| V  | 100|
|                                 | S  | 2  | 1  | 2  | 4  | 3  | 2  | 3  | 3  | 2  | 1–4 | V | 100|
| **Crataegus monogyna (Qpp)**    | A2 | +  | +  | –  | –  | –  | –  | –  | –  | –  | 2   | +2| II | 30 |
|                                 | B1 | 2  | 2  | +  | –  | +  | 1  | +  | +  | +  | +   | +2| V  | 90 |
|                                 | B2 | +  | +  | +  | +  | +  | +  | +  | +  | +  | +   | + | V  | 100|
|                                 | S  | 2  | 2  | +  | +  | +  | 1  | +  | +  | +  | 2   | +2| V  | 100|
| **Geum urbanum (Epa,Cp,Qpp)**   | C  | +  | +  | +  | +  | +  | +  | +  | +  | +  | +   |  V| 100|
| **Ligustrum vulgare (Cp,Qpp)**  | B1 | +  | +  | 2  | 3  | 2  | 2  | +  | 1  | 3  | +3  | III| 50 |
|                                 | B2 | +  | +  | 1  | 1  | +  | 1  | 1  | 2  | +2 | V   | 100|
|                                 | S  | +  | +  | 1  | 2  | +  | 2  | 2  | 1  | 2  | 4   | +4| V  | 100|
| **Euonymus europaeus (Qpp)**    | B1 | –  | +  | –  | +  | –  | +  | –  | +  | +  | +   | III| 50 |
|                                 | B2 | –  | –  | –  | +  | –  | +  | +  | +  | +  | +   | III| 60 |
|                                 | S  | –  | +  | +  | +  | +  | +  | +  | +  | +  | +   | V  | 90 |
| **Rhamnus catharticus (Qpp,Pru)** | A2 | –  | –  | –  | –  | –  | –  | –  | –  | –  | +   | I  | 10 |
|                                 | B1 | –  | –  | –  | –  | +  | +  | +  | –  | +  | +   | III| 50 |
|                                 | B2 | +  | +  | +  | +  | +  | +  | –  | +  | +  | V   | 90 |
|                                 | S  | +  | +  | +  | +  | 1  | –  | +  | +  | +  | –1  | V  | 90 |
| **Scrophularia nodosa (GA,Epa)**| C  | +  | –  | +  | +  | +  | +  | +  | +  | +  | +   | V  | 90 |
| **Quercus robur (Ai,Cp,Qpp)**   | A1 | –  | –  | –  | –  | 1  | 2  | –  | –  | 2  | 1–2 | II | 40 |
|                                 | A2 | –  | –  | +  | –  | –  | –  | –  | –  | +  | +   | I  | 20 |
|                                 | B1 | –  | –  | –  | –  | +  | –  | –  | –  | –  | +   | I  | 10 |

DRAINED ASH SWAMP IN THE NYÍRSÉG, NE HUNGARY
**Table 1 (continued)**

|                          | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | A–D | K | % |
|--------------------------|---|---|---|---|---|---|---|---|---|----|-----|---|---|
| **Quercus robur (Ai,Cp,Qpp)** |   |   |   |   |   |   |   |   |   |    |     |   |   |
| B2                       | – | + | + | – | – | – | + | + | + | –  | III | 50 |   |
| S                        | – | + | + | – | 1 | 1 | 2 | + | + | 2  | IV  | 80 |   |
| **Ulmus minor (Ai,Ulm,Qpp)** |   |   |   |   |   |   |   |   |   |    |     |   |   |
| A2                       | 1 | 1 | 2 | – | – | – | + | 1 | – | 1  | III | 60 |   |
| B1                       | + | + | 2 | – | – | – | + | + | – | 2  | III | 60 |   |
| B2                       | + | + | + | – | – | + | + | + | – | +  | IV  | 70 |   |
| S                        | 1 | 1 | 3 | – | – | + | 1 | 1 | – | 2  | +3  | IV | 70 |
| **Corylus avellana (Qpp)** |   |   |   |   |   |   |   |   |   |    |     |   |   |
| A2                       | 1 | 1 | – | – | – | – | – | – | – | 1  | I   | 20 |   |
| B1                       | 2 | + | + | – | – | – | 1 | – | + | –2 | III | 50 |   |
| B2                       | + | + | + | – | – | + | – | + | + | 1  | III | 60 |   |
| S                        | 2 | 1 | + | + | – | – | 1 | – | + | –2 | III | 60 |   |
| **Dactylis polygama (Qpp,Cp)** |   |   |   |   |   |   |   |   |   |    |     |   |   |
| C                        | + | 1 | + | + | – | – | – | + | 1 | +1 | III | 60 |   |
| **Geranium robertianum (Epa)** |   |   |   |   |   |   |   |   |   |    |     |   |   |
| C                        | + | + | 1 | – | + | – | – | – | + | +  | +1  | III | 60 |   |
| **Veronica chamaedrys (Qpp,Ara)** |   |   |   |   |   |   |   |   |   |    |     |   |   |
| C                        | – | + | + | + | – | – | – | + | – | +  | III | 60 |   |
| **Convallaria majalis (Qpp)** |   |   |   |   |   |   |   |   |   |    |     |   |   |
| C                        | 3 | 4 | + | – | – | – | – | 4 | – | 1  | +4  | III | 50 |   |
| **Populus tremula (Qr,Qc,Ber)** |   |   |   |   |   |   |   |   |   |    |     |   |   |
| A1                       | + | – | – | – | – | – | – | 1 | – | +1 | I    | 20 |   |
| A2                       | 1 | – | + | – | – | – | – | – | – | +1 | I    | 20 |   |
| B1                       | + | – | – | – | – | + | – | – | – | +  | I    | 20 |   |
| B2                       | – | + | + | – | – | + | – | + | + | 1  | II   | 30 |   |
| S                        | 1 | – | + | – | – | + | – | 1 | + | +1 | III  | 50 |   |
| **Ajuga reptans (MoA)** |   |   |   |   |   |   |   |   |   |    |     |   |   |
| C                        | – | – | – | – | + | 1 | 1 | 1 | – | –  | +1  | II  | 40 |   |
| **Campanula trachelium (Epa,Cp)** |   |   |   |   |   |   |   |   |   |    |     |   |   |
| C                        | + | 1 | 1 | + | – | – | – | – | – | +1 | II   | 40 |   |
Table 1 (continued)

| Species                                           | Column 1 | Column 2 | Column 3 | Column 4 | Column 5 | Column 6 | Column 7 | Column 8 | Column 9 | Column 10 | A–D | K | % |
|---------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----|---|---|
| Carex spicata (Qpp,Epa)                           | C        | –        | –        | +        | +        | –        | –        | +        | –        | –         | II  | 40|   |
| Heracleum sphondylium (Qpp,MoA)                   | C        | +        | +        | +        | –        | –        | –        | –        | –        | +         | II  | 40|   |
| Polygonatum latifolium (Qpp)                      | C        | +        | +        | –        | –        | –        | –        | –        | +        | +         | II  | 40|   |
| Cruciata glabra                                   | C        | +        | +        | –        | –        | –        | –        | –        | +        | –         | II  | 30|   |
| Ranunculus auricomus agg. (MoA)                   | C        | –        | –        | –        | –        | –        | +        | +        | –        | +         | II  | 30|   |
| Carex divulsa                                     | C        | –        | –        | –        | –        | –        | –        | –        | –        | –         | I   | 20|   |
| Fragaria vesca (Qpp,Epa)                          | C        | –        | –        | –        | –        | +        | –        | –        | +        | –         | I   | 20|   |
| Galeopsis pubescens (Qpp,Epa)                     | C        | –        | –        | –        | +        | –        | –        | –        | +        | +         | I   | 20|   |
| Veronica hederifolia subsp. lucorum               | C        | –        | +        | +        | –        | –        | –        | –        | –        | +         | I   | 20|   |
| Acer campestre (Qpp)                              | A2       | 1        | –        | –        | –        | –        | –        | –        | –        | 1         | I   | 10|   |
|                                                   | B1       | +        | –        | –        | –        | –        | –        | –        | –        | –         | I   | 10|   |
|                                                   | B2       | +        | –        | –        | –        | –        | –        | –        | –        | +         | I   | 10|   |
|                                                   | S        | 1        | –        | –        | –        | –        | –        | –        | –        | –         | I   | 10|   |
| Cephalanthera damasonium (Qpp)                    | C        | –        | –        | –        | –        | +        | –        | –        | –        | +         | I   | 10|   |
| Cephalanthera longifolia                         | C        | –        | –        | –        | –        | +        | –        | –        | –        | –         | I   | 10|   |
| Lapsana communis (Qpp,GA,Epa)                     | C        | +        | –        | –        | –        | –        | –        | –        | –        | +         | I   | 10|   |
| Mycelis muralis                                   | C        | –        | –        | –        | –        | +        | –        | –        | –        | –         | I   | 10|   |
| Platanthera bifolia (Qpp,PQ,NC,Moa)               | C        | –        | –        | –        | –        | +        | –        | –        | –        | –         | I   | 10|   |
| Poa nemoralis (Qpp)                               | C        | +        | –        | –        | –        | –        | –        | –        | –        | +         | I   | 10|   |
| Vicia sepium (Ara,Qpp)                            | C        | –        | –        | –        | –        | –        | –        | –        | –        | +         | I   | 10|   |
| Viola mirabilis (F,Qpp)                           | C        | +        | –        | –        | –        | –        | –        | –        | –        | +         | I   | 10|   |
### Table 1 (continued)

| 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | A–D | K | % |
|----|----|----|----|----|----|----|----|----|----|-----|---|---|
| **1.3.1. Fagetalia sylvaticae** |    |    |    |    |    |    |    |    |    |     |   |   |
| *Listera ovata* (Ate,Ai)      | C  | −  | +  | +  | −  | +  | +  | +  | +  | +   | IV| 80|   |
| *Moehringia trinervia*        | C  | +  | +  | +  | +  | −  | +  | −  | +  | +   | IV| 70|   |
| *Carex sylvatica*             | C  | 1  | 1  | +  | +  | −  | −  | −  | −  | −   | +1| 40|   |
| *Stachys sylvatica* (Epa)     | C  | +  | 1  | +  | +  | −  | −  | −  | −  | −   | +1| 40|   |
| *Circaea lutetiana* (Ai)      | C  | −  | +  | +  | −  | −  | −  | −  | −  | −   | + | 30|   |
| *Milium effusum*              | C  | +  | +  | −  | −  | −  | −  | −  | −  | −   | + | 20|   |
| *Aegopodium podagraria* (Ai,Cp)| C  | +  | −  | −  | −  | −  | −  | −  | −  | −   | + | 10|   |
| *Cardamine bulbifera*         | C  | −  | −  | +  | −  | −  | −  | −  | −  | −   | + | 10|   |
| *Carpinus betulus* (Cp)       | B2 | −  | −  | −  | −  | +  | −  | −  | −  | −   | + | 10|   |
| *Epipactis helleborine agg.*  | C  | −  | −  | −  | +  | −  | −  | −  | −  | −   | + | 10|   |
| *Galeopsis speciosa* (Epn,Ai) | C  | −  | −  | −  | −  | −  | −  | −  | −  | +   | + | 10|   |
| *Polygonatum multiflorum* (QFt)| C  | +  | −  | −  | −  | −  | −  | −  | −  | +   | + | 10|   |
| **1.3.1.1. Alnion incanae**   |    |    |    |    |    |    |    |    |    |     |   |   |
| *Fraxinus angustifolia* subsp. *danubialis* (Ate) | A1 | 4  | 4  | 3  | 3  | 4  | 4  | 3  | 4  | 2–4 | V  | 100|   |
|                               | A2 | 2  | 3  | 3  | 2  | 3  | 2  | 2  | 2  | 2   | 2–3| V  | 100|   |
|                               | B1 | 1  | −  | 2  | 1  | 1  | 2  | 2  | 2  | 1   | +  | +2| 90 |   |
|                               | B2 | 1  | −  | +  | 2  | 2  | 2  | 2  | 1  | 2   | +2| 90 |   |
|                               | S  | 5  | 5  | 4  | 5  | 5  | 5  | 5  | 3  | 3–5 | 3–5| V  | 100|   |
| *Populus alba* (Sal,AQ)       | A1 | 1  | 2  | 2  | 1  | 1  | 1  | 2  | 3  | 1–3 | V  | 100|   |
|                               | A2 | −  | −  | 1  | 1  | −  | −  | −  | −  | +   | +1| 30|   |
| Species                        | Site | Sign | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | A–D | K | % |
|-------------------------------|------|------|---|---|---|---|---|---|---|---|---|----|-----|---|---|
| *Populus alba* (Sal,AQ)       | B1   | ±   | - | - | - | - | - | - | - | + | + | I   | 20  |
|                               | B2   | ±   | + | + | - | - | + | + | + | + | + | IV  | 80  |
|                               | S    |     | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 3 | 1–3 | V   | 100 |
| *Viburnum opulus* (Ate)       | B1   | -   | - | - | 1 | - | - | - | - | + | + | +1 | I   | 20  |
|                               | B2   | +   | + | + | 1 | + | + | + | + | + | 1 | +1 | V   | 100 |
|                               | S    | +   | + | + | 2 | + | + | + | + | + | 1 | +1 | V   | 100 |
| *Frangula alnus* (Ate,Qr,PQ)  | B1   | -   | + | + | + | + | + | + | + | + | + | IV  | 70  |
|                               | B2   | -   | - | + | + | + | + | + | + | + | + | IV  | 70  |
|                               | S    | -   | + | + | + | + | + | + | + | + | + | V   | 90  |
| *Elymus caninus* (Pna,Qpp)    | C    | +   | + | + | + | + | - | - | - | - | + | + | III | 60  |
| *Festuca gigantea* (Cal,Epa)  | C    | -   | + | + | - | - | - | 1 | - | - | + | +1 | II  | 40  |
| *Rumex sanguineus* (Epa,Pna)  | C    | +   | - | + | - | - | - | - | - | - | + | + | II  | 30  |
| *Carex remota*                | C    | +   | - | - | - | - | - | - | - | - | + | + | I   | 20  |
| *Equisetum hyemale* (F)       | C    | +   | - | - | - | - | - | - | - | - | + | + | I   | 20  |
| *Ribes rubrum*                | B1   | -   | - | - | - | - | - | - | - | - | + | + | I   | 10  |
|                               | B2   | +   | - | - | - | - | - | - | - | - | + | + | I   | 10  |
|                               | S    | -   | + | - | - | - | - | - | - | - | + | + | I   | 20  |
| *Ulmus laevis* (Sal,Ulm)      | A1   | -   | - | - | - | - | - | + | - | - | 2 | +2 | I   | 20  |
|                               | A2   | -   | - | - | - | - | - | - | - | - | + | + | I   | 10  |
|                               | B1   | -   | - | - | - | - | - | - | - | - | + | + | I   | 10  |
|                               | B2   | -   | - | - | - | - | - | + | - | - | - | + | I   | 10  |
|                               | S    | -   | - | - | - | - | + | - | - | - | 2 | +2 | I   | 20  |
Table 1 (continued)

|                              | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | A–D | K | % |
|------------------------------|---|---|---|---|---|---|---|---|---|----|-----|---|---|
| **Malus sylvestris (Qpp)**   | B2| - | + | - | - | - | - | - | - | +  | I   | 10|   |
| **Padus avium**              | A2| - | - | - | - | - | - | - | - | +  | +   | I | 10|
|                              | B1| - | - | - | - | - | - | - | - | +  | +   | I | 10|
|                              | B2| - | - | - | - | - | - | - | - | +  | +   | I | 10|
|                              | S | - | - | - | - | - | - | - | - | 1  | 1   | I | 10|
| **Viola elatior (Moa)**      | C | - | - | - | - | - | - | + | - | -  | +   | I | 10|

### 1.4. Quercetea pubescentis-petraeae

| **Prunus spinosa (Pru,Prf)** | B1| - | - | + | + | - | + | - | - | +  | III | 50|
|                              | B2| - | - | + | + | + | + | - | + | +  | IV  | 70|
|                              | S | - | - | + | + | + | + | - | + | +  | IV  | 70|
| **Pyrus pyraster (Cp)**       | A1| - | - | - | - | - | 1 | - | - | -  | I   | 10|
|                              | A2| - | - | + | - | 1 | 2 | + | - | +  | +   | +2 | 30|
|                              | B1| - | - | - | - | - | + | + | - | -  | I   | 20|
|                              | B2| - | + | - | - | + | - | - | - | -  | +   | II  | 30|
|                              | S | - | + | + | - | + | 1 | 2 | + | -  | +   | +2 | 40|
| **Clinopodium vulgare**       | C | - | + | + | + | + | + | - | - | +  | III | 60|
| **Betonica officinalis (MoA)**| C | + | - | - | - | + | + | - | + | +  | III | 50|
| **Carex michelii**            | C | + | - | - | - | + | - | - | - | +  | II  | 30|
| **Pulmonaria mollissima**     | C | - | - | + | + | + | - | - | - | -  | +   | II  | 30|
| **Rosa canina agg. (Pru,Prf)**| B1| - | - | + | - | - | - | - | - | +  | I   | 10|
|                              | B2| - | + | + | - | - | - | - | - | +  | II  | 30|
|                              | S | - | + | + | - | - | - | - | - | +  | II  | 30|
### Table 1 (continued)

| Species                                    | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | A–D | K | % |
|--------------------------------------------|---|---|---|---|---|---|---|---|---|----|-----|---|---|
| *Astragalus glycyphyllos*                  | C | + | − | − | − | − | − | − | − | +  | I   | 20|   |
| *Lactuca quercina* subsp. *sagittata*      | C | + | − | − | − | − | − | − | − | +  | I   | 20|   |
| *Euonymus verrucosus* (Pru)                | B1| + | − | − | − | − | − | − | − | +  | I   | 10|   |
|                                            | B2| + | − | − | − | − | − | − | − | +  | I   | 10|   |
|                                            | S | + | − | − | − | − | − | − | − | +  | I   | 10|   |
| *Inula salicina* (MoA,Fvg)                 | C | − | − | − | + | − | − | − | − | +  | I   | 10|   |
| *Melampyrum cristatum* (Fvl)               | C | − | − | − | − | − | − | − | − | +  | I   | 10|   |
| *Polygonatum odoratum* (Fvl)               | C | − | − | − | − | − | − | − | − | +  | I   | 10|   |
| 1.4.1. Quercetalia cerridis                |   |   |   |   |   |   |   |   |   |    |     |   |   |
| *Gagea pratensis* (Sea)                    | C | − | − | − | − | − | + | − | − | −  | +  | I   | 10|   |
| *Trifolium medium*                         | C | − | − | − | − | − | + | − | − | −  | +  | I   | 10|   |
| 1.4.1.1. Aceri tatarici-Quercion           |   |   |   |   |   |   |   |   |   |    |     |   |   |
| *Acer tataricum* (Qpp)                     | B1| + | + | + | − | − | − | − | − | +  | II  | 30|   |
|                                            | B2| + | + | + | − | − | − | − | − | +  | II  | 30|   |
|                                            | S | + | + | + | − | − | − | − | − | +  | II  | 30|   |
| 2. Cypero-Phragmitea                       |   |   |   |   |   |   |   |   |   |    |     |   |   |
| 2.1. Phragmitetea                          |   |   |   |   |   |   |   |   |   |    |     |   |   |
| *Eupatorium cannabinum* (Epa,Sal,Ate,Ai)   | C | + | + | + | + | + | + | + | − | +  | V   | 90|   |
| *Carex acutiformis* (Mag,Cgr,Moj,Sal,Ate)  | C | − | + | − | 1 | − | + | + | + | 1  | +1  | III | 60|   |
| *Iris pseudacorus* (Sal,Ate,Ai)           | C | − | + | + | − | − | + | + | − | −  | +  | III | 50|   |
| *Hypericum tetragonum* (FiC)              | C | − | + | + | + | − | − | − | − | −  | +  | II  | 30|   |
| *Lycopus europaeus* (Moa,Cal,Bia,Spu,Ate) | C | − | − | − | − | − | − | − | + | +  | I   | 20|   |
| Code | Species | Section | Compositional Characteristics | Dominant Species | Relative Abundance |
|------|---------|---------|------------------------------|------------------|-------------------|
| Acta Bot. Hung. 61, 2019 | | | | | |
### 3.1. Molinio-Juncetea

**Veratrum album** (Ate, Ai)  
| C | + | + | + | + | + | 2 | + | 2 | 1 | 1 | +–2 | V | 90 |

**Cirsium canum** (Mag, Ate, Ai)  
| C | – | – | + | + | + | – | + | – | + | + | + | III | 60 |

**Deschampsia caespitosa** (Des, Sal, Ate, Ai)  
| C | – | – | – | – | + | 2 | 1 | 1 | + | + | +–2 | III | 60 |

**Cirsium rivulare** (Mag, Ate, Ai)  
| C | – | + | + | – | – | – | – | – | + | – | + | II | 40 |

**Symphytum officinale** (Pte, Cal, Spu, Ate, Ai)  
| C | – | – | – | – | + | – | – | + | + | + | + | II | 40 |

**Selinum carvifolia** (Mon, Ate, PQ)  
| C | – | – | – | – | + | – | – | – | + | – | + | I | 20 |

**Succisa pratensis** (Mon, Tof, NC)  
| C | – | – | – | – | – | – | – | – | + | + | – | I | 10 |

#### 3.1.1. Molinietalia coeruleae

**Angelica sylvestris** (Mag, Ate, Ai)  
| C | + | + | 1 | + | + | + | + | + | + | + | +–1 | V | 100 |

**Valeriana officinalis** (Mag, FiC)  
| C | – | – | – | + | + | + | + | + | + | + | + | IV | 70 |

**Ophioglossum vulgatum** (NC, Arn)  
| C | – | – | – | – | + | + | + | + | + | + | + | III | 60 |

**Trollius europaeus** (Ate)  
| C | – | + | – | + | + | + | + | – | + | – | + | III | 60 |

**Orchis militaris** (FBt, Qpp)  
| C | – | – | – | – | + | + | – | – | – | – | + | I | 20 |

#### 3.1.1.1. Filipendulo-Cirsion oleracei

**Filipendula ulmaria** (Moa, Sal, Ate, Ai)  
| C | + | + | 1 | 1 | + | + | + | + | + | + | +–1 | V | 100 |

**Geranium palustre** (Ate)  
| C | + | + | 1 | + | + | + | + | + | – | – | +–1 | IV | 80 |

#### 4. Festuco-Bromea

**Campanula glomerata** (Qpp)  
| C | – | – | – | + | – | – | + | – | – | + | II | 30 |

#### 5. Chenopodio-Scleranthea

##### 5.1. Secalieta

**Muscari comosum** (FBt)  
| C | – | – | – | – | – | – | – | – | + | – | + | I | 10 |
### Table 1 (continued)

| Category                      | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | A–D | K | %  |
|--------------------------------|---|---|---|---|---|---|---|---|---|----|-----|---|----|
| **5.2. Chenopodietea**        |   |   |   |   |   |   |   |   |   |    |     |   |    |
| *Arctium minus* (Ar,Bia,Pla)  | C | + | - | + | - | + | - | + | - | +  | III | 50 |
| **5.3. Galio-Urticetea**      |   |   |   |   |   |   |   |   |   |    |     |   |    |
| **5.3.1. Calystegietalia sepium** |   |   |   |   |   |   |   |   |   |    |     |   |    |
| **5.3.1.1. Galio-Alliarion**  |   |   |   |   |   |   |   |   |   |    |     |   |    |
| *Chaerophyllum temulum*       | C | + | + | - | + | 1 | - | - | + | -  | +−1 | III | 60 |
| *Alliaria petiolata* (Epa)    | C | - | - | - | + | + | - | - | - | +  | II  | 30 |
| **5.3.1.2. Calystegion sepium** |   |   |   |   |   |   |   |   |   |    |     |   |    |
| *Myosoton aquaticum* (Pte,Spu,Ate,Ai) | C | - | + | - | + | - | - | - | - | -  | +  | I  | 20 |
| *Bryonia alba* (Ar,GA)        | C | - | - | + | - | - | - | - | - | -  | +  | I  | 10 |
| *Calystegia sepium* (Pte,Bia,Pla,Spu,Ate) | C | - | - | - | - | - | - | - | + | +  | I  | 10 |
| **5.4. Epilobietea angustifolii** |   |   |   |   |   |   |   |   |   |    |     |   |    |
| **5.4.1. Epilobietalia**      |   |   |   |   |   |   |   |   |   |    |     |   |    |
| *Galeopsis bifida* (Cal)      | C | - | - | + | - | - | - | - | - | -  | +  | I  | 10 |
| *Salix caprea* (US,QFt)       | A2| - | - | - | - | - | - | - | - | +  | +  | I  | 10 |
| **6. Indifferens**            |   |   |   |   |   |   |   |   |   |    |     |   |    |
| *Equisetum arvense* (Mo,A,Sea,Sal,Ate,Ai) | C | + | + | + | + | + | + | + | + | +  | V   | 100 |
| *Galium aparine* (Sea,Epa,QFt) | C | + | 1 | + | + | + | + | + | 1 | +  | +−1 | V   | 100 |
| *Lysimachia nummularia* (Pte,MoJ,Bia) | C | + | + | + | + | + | + | + | 1 | +  | +−1 | V   | 100 |
| *Rubus caesius* (Spu)         | B2| + | + | 1 | 1 | 1 | 1 | - | + | +  | 1   | +−1 | V   | 90  |
| *Torilis japonica* (Ar,GA,Epa,QFt) | C | + | + | + | + | + | + | + | - | +  | V   | 90  |
| *Glechoma hederacea* (MoA,QFt,Sal,Ai) | C | + | + | 1 | 1 | + | + | - | + | -  | +−1 | IV  | 80  |
| Species (Common Names) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | A–D | K | % |
|------------------------|---|---|---|---|---|---|---|---|---|----|-----|---|---|
| *Taraxacum officinale* agg. (MoA,ChS) | C | + | – | + | – | + | + | + | + | – | + | IV | 70 |
| *Urtica dioica* (Ar,GA,Epa,Spu) | C | – | – | – | + | + | + | + | + | – | + | III | 60 |
| *Sambucus nigra* (Epa,US,QFt) | B2 | – | – | + | – | + | – | – | + | + | + | III | 50 |
| *Caltha palustris* (Mag,MoJ,Spu,Ate,Ai) | C | – | + | + | – | – | – | – | + | + | + | II | 40 |
| *Galium mollugo* (MoA,FBt,Qrp,Qpp) | C | – | – | + | + | – | – | – | – | + | + | + | II | 40 |
| *Ranunculus repens* (Pte,MoA,ChS,Spu,Ate) | C | – | – | – | + | – | – | – | + | + | + | II | 40 |
| *Serratula tinctoria* (MoA,MoJ,Qrp,Qpp,PQ) | C | – | – | – | – | + | – | – | – | + | + | I | 20 |
| *Stellaria media* (ChS,QFt,Spu) | C | – | + | + | – | – | – | – | – | – | + | I | 20 |
| *Carex hirta* (Pte,MoA,Pla) | C | – | – | – | + | – | – | – | – | – | – | I | 10 |
| *Lamium album* (Ar,GA,Cal) | C | – | – | – | – | – | – | – | – | – | + | I | 10 |
| *Lysimachia vulgaris* (Ai,Pte,SCn,MoJ,Sal) | C | – | – | – | – | – | – | – | + | + | + | I | 10 |
| *Mentha aquatica* (Pte,Moa,Spu,Ate,Ai) | C | – | – | – | – | – | – | – | – | + | + | + | I | 10 |
| *Prunella vulgaris* (Pte,MoA,ChS,QFt) | C | – | – | – | – | – | – | – | – | – | + | + | I | 10 |
| *Pseudolysimachion longifolium* (Des,FiC) | C | – | – | – | – | + | – | – | – | + | + | I | 10 |
| **7. Adventiva** | | | | | | | | | | | | | |
| *Fraxinus pennsylvanica* | A2 | – | – | – | – | + | 2 | – | 1 | – | – | +–2 | II | 30 |
| | B1 | – | – | – | – | 1 | 1 | + | – | – | – | +–1 | II | 30 |
| | B2 | – | – | – | – | + | + | + | + | – | – | + | II | 40 |
| | S | – | – | – | – | + | + | + | + | – | – | +–2 | II | 40 |
| *Acer negundo* | B1 | – | + | – | – | – | – | – | – | – | – | + | I | 10 |
| | B2 | – | + | + | – | – | – | – | – | – | – | + | I | 20 |
| | S | – | + | + | – | – | – | – | – | – | – | + | I | 20 |
Frequency distribution of constancy classes

The ten samples included 22 constant (K: V) and 12 sub-constant (K: IV) species. The number of accessorial (K: III), sub-accessorial (K: II), and accidental (K: I) species in the samples was 19, 37, and 69, respectively (see Table 1).

Table 1

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|----|
| A–D | K | % |
| B2 | I | 20 | + |
| B2 | I | 10 | + |
| B2 | I | 10 | + |
| B2 | I | 10 | + |
| B2 | I | 10 | + |
| B2 | I | 10 | + |
| B2 | I | 10 | + |
| B2 | I | 10 | + |
| B2 | I | 10 | + |
| B2 | I | 10 | + |

Fig. 4. Frequency distribution of species in different constancy classes in *Veratro albi-Fraxinetum angustifoliae*

Fig. 5. Proportion of Alnetea glutinosae s. l. character species. Fr-A = *Fraxino pannonicae-Alnetum*, Nyírség (Kevey and Papp L. ined.: 5 relevés); V-Fr = *Veratro albi-Fraxinetum angustifoliae*, Nyírség (Kevey and Papp L. ined.: 10 relevés); Fr-U = *Fraxino pannonicae-Ulmetum*, Nyírség (Kevey et al. 2017: 20 relevés)
Table 2

Data of the relevés

| Number of sample plot | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                       | 5932| 5935| 15808| 15809| 5921| 5924| 5927| 5928| 5930| 15807|
| Year of first sampling 1 | 2004| 2004| 2005| 2007| 2004| 2004| 2004| 2004| 2004| 2007|
| Month and day of first sampling 1 | 04.26| 04.26| 08.20| 04.22| 04.26| 04.26| 04.26| 04.26| 06.25| 04.22|
| Year of first sampling 2 | 2004| 2004| 2007| 2007| 2004| 2004| 2004| 2004| 2007| 2007|
| Month and day of first sampling 2 | 06.26| 06.26| 04.22| 08.12| 06.25| 06.25| 06.25| 06.25| 04.22| 08.12|
| Altitude above sea level (m) | 137| 137| 137| 137| 130| 130| 130| 130| 133| 133|
| Exposition | 0| 0| 0| 0| 0| 0| 0| 0| 0| 0|
| Cover of upper canopy layer (%) | 75| 80| 60| 65| 75| 70| 65| 70| 70| 65|
| Cover of lower canopy layer (%) | 30| 40| 60| 25| 40| 40| 40| 25| 20| 40|
| Cover of shrub layer (%) | 50| 25| 50| 70| 50| 60| 40| 60| 50| 70|
| Cover of saplings (%) | 3| 1| 15| 50| 25| 25| 40| 5| 30| 40|
| Cover of understory (%) | 80| 85| 85| 35| 60| 65| 60| 80| 70| 50|
| Height of upper canopy layer (m) | 28| 28| 22| 25| 25| 22| 20| 25| 27| 25|
| Height of lower canopy layer (m) | 16| 15| 15| 15| 18| 16| 15| 18| 20| 12|
| Height of shrub layer (m) | 3| 3,5| 2,5| 3| 3| 3| 1,5| 3| 2,5| 3|
| Mean trunk diameter (cm) | 55| 60| 40| 50| 45| 40| 35| 40| 45| 50|
| Area of sample plot (m²) | 1600| 1600| 1600| 1600| 1600| 1600| 1600| 1200| 1600| 1600|

Location: 1–4: Nyírábrány “Mogyorósi-erdő”; 5–8: Nyíracsád “Jónásrész-Kőrises”; 9: Nyíracsád; “Jónásrész-Buzita”; 10: Nyírábrány “Kis-kőrises”

Type of baserock: 1–10: sand. Soil type: peaty soil with decaying peat.

Authors: 1–3, 5–10, Kevey and Papp L. ined.; 4 : Kevey ined.
Fig. 6. Proportion of Saliceta purpureae s. l. character species. Fr-A = Fraxino pannonicae-Alnetum, Nyírség (Kevey and Papp L. ined.: 5 relevés); V-Fr = Veratro albi-Fraxinetum angustifolii, Nyírség (Kevey and Papp L. ined.: 10 relevés); Fr-U = Fraxino pannonicae-Ulmetum, Nyírség (Kevey et al. 2017: 20 relevés)

Fig. 7. Proportion of Alnion incanae s. l. character species. Fr-A = Fraxino pannonicae-Alnetum, Nyírség (Kevey and Papp L. ined.: 5 relevés); V-Fr = Veratro albi-Fraxinetum angustifolii, Nyírség (Kevey and Papp L. ined.: 10 relevés); Fr-U = Fraxino pannonicae-Ulmetum, Nyírség (Kevey et al. 2017: 20 relevés)

Fig. 8. Proportion of Fagetalia character species. Fr-A = Fraxino pannonicae-Alnetum, Nyírség (Kevey and Papp L. ined.: 5 relevés); V-Fr = Veratro albi-Fraxinetum angustifolii, Nyírség (Kevey and Papp L. ined.: 10 relevés); Fr-U = Fraxino pannonicae-Ulmetum, Nyírség (Kevey et al. 2017: 20 relevés)

Fig. 9. Proportion of Phragmitetea s. l. character species. Fr-A = Fraxino pannonicae-Alnetum, Nyírség (Kevey and Papp L. ined.: 5 relevés); V-Fr = Veratro albi-Fraxinetum angustifolii, Nyírség (Kevey and Papp L. ined.: 10 relevés); Fr-U = Fraxino pannonicae-Ulmetum, Nyírség (Kevey et al. 2017: 20 relevés)
Table 3  
Percentages of characteristic species in *Veratro albi- Fraxinetum angustifoliae* and five similar associations selected for comparison

| Association               | Fr-A | V-Fr | O-B | M-A | M-S | Fr-U | Fr-A | V-Fr | O-B | M-A | M-S | Fr-U |
|---------------------------|------|------|-----|-----|-----|------|------|------|-----|-----|-----|------|
| Querco-Fagea              | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Salicetalia purpureae     | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Salicetalia purpureae     | 8.2  | 2.0  | 1.5 | 3.6 | 3.8 | 1.3  | 2.2  | 0.5  | 0.2 | 2.5 | 4.6 | 0.3  |
| Salicetalia purpureae     | 6.6  | 3.3  | 1.9 | 3.0 | 3.7 | 1.6  | 8.0  | 2.7  | 1.3 | 3.9 | 2.2 | 1.9  |
| Salicetalia purpureae     | 8.2  | 2.0  | 1.5 | 3.6 | 3.8 | 1.3  | 2.2  | 0.5  | 0.2 | 2.5 | 4.6 | 0.3  |
| Salicetalia purpureae s. l.| 14.8 | 5.8  | 3.4 | 6.7 | 8.0 | 3.1  | 10.2 | 3.3  | 1.5 | 6.4 | 8.6 | 2.2  |
| Alnetalia glutinosae      | 13.9 | 8.2  | 5.0 | 7.4 | 7.6 | 2.3  | 25.4 | 17.7 | 13.0 | 18.5 | 15.5 | 5.6  |
| Alnetalia glutinosae      | 1.1  | 0.8  | 0.0 | 0.7 | 1.0 | 0.0  | 1.7  | 0.1  | 0.0 | 0.8 | 11.7 | 0.0  |
| Alnetalia glutinosae s. l.| 15.0 | 9.0  | 5.0 | 8.1 | 8.6 | 2.3  | 27.1 | 17.8 | 13.0 | 19.3 | 27.2 | 5.6  |
| Alnetalia glutinosae s. l.| 15.0 | 9.0  | 5.0 | 8.1 | 8.6 | 2.3  | 27.1 | 17.8 | 13.0 | 19.3 | 27.2 | 5.6  |
| Querco-Fagetea            | 2.7  | 13.0 | 9.8 | 4.9 | 2.1 | 20.7 | 0.2  | 21.9 | 12.8 | 6.0 | 0.8 | 25.4 |
| Fagatalia sylvaticae      | 0.3  | 3.9  | 7.0 | 0.2 | 0.3 | 19.9 | 0.0  | 0.7  | 1.2 | 0.0 | 0.0 | 17.2 |
| Alnion incanae            | 12.9 | 9.8  | 5.2 | 6.0 | 5.1 | 8.1  | 21.0 | 20.8 | 1.5 | 17.1 | 13.4 | 13.8 |
| Alnienion glutinosae-incanae | 0.9  | 0.0  | 0.5 | 0.0 | 0.0 | 6.2  | 0.0  | 0.0  | 12.8 | 0.0 | 0.0 | 0.0  |
| Almienion                | 0.0  | 0.8  | 0.3 | 0.4 | 0.3 | 1.1  | 0.0  | 0.9  | 0.0 | 0.1 | 0.1 | 1.2  |
| Almienion incanae s. l.   | 13.8 | 10.6 | 5.5 | 6.9 | 5.4 | 9.2  | 27.2 | 21.7 | 1.5 | 30.0 | 13.5 | 15.0 |
### Table 3 (continued)

| Percentage of characteristic species in K% | Percentage of characteristic species in A-D |
|------------------------------------------|------------------------------------------|
| Fr-A | V-Fr | O-B | M-A | M-S | Fr-U | Fr-A | V-Fr | O-B | M-A | M-S | Fr-U |
|------|------|-----|-----|-----|------|------|------|-----|-----|-----|------|
| Fagion sylvaticae | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Eu-Fagenion | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Carpinenion betuli | 0.1 | 2.5 | 1.8 | 1.1 | 0.4 | 4.1 | 0.0 | 2.7 | 0.2 | 0.2 | 0.1 |
| Tilio-Acerenion | 0.0 | 0.0 | 0.6 | 0.1 | 0.0 | 0.5 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
| Fagion sylvaticae s. l. | 0.1 | 2.5 | 2.4 | 1.2 | 0.4 | 4.9 | 0.0 | 2.7 | 0.3 | 0.2 | 0.1 |
| Aremonio-Fagion | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Fagetalia sylvaticae s. l. | 14.2 | 17.0 | 14.9 | 8.3 | 6.1 | 34.4 | 27.2 | 25.1 | 3.0 | 30.2 | 13.6 |
| Quercetalia roboris | 0.6 | 0.6 | 1.3 | 0.5 | 0.2 | 0.5 | 0.1 | 0.1 | 11.4 | 0.1 | 0.1 |
| Quercion robori-petraeae | 0.0 | 0.2 | 0.4 | 0.4 | 0.3 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 |
| Quercetalia roboris s. l. | 0.6 | 0.8 | 1.7 | 0.9 | 0.5 | 0.5 | 0.1 | 0.1 | 11.5 | 0.2 | 0.2 |
| Querco-Fagetalia s. l. | 17.5 | 30.8 | 26.4 | 14.1 | 8.7 | 55.6 | 27.5 | 47.1 | 27.3 | 36.4 | 14.6 |
| Quercetea pubescentis-petraeae | 1.1 | 14.1 | 11.3 | 9.0 | 6.9 | 13.5 | 0.1 | 21.9 | 12.4 | 6.6 | 1.6 |
| Orno-Cotinetalia | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Orno-Cotinion | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Orno-Cotinetalia s. l. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Quercetalia cerridis | 0.1 | 0.4 | 0.0 | 0.2 | 0.2 | 0.3 | 0.0 | 0.1 | 0.1 | 0.1 | 0.0 |
| Quercion farnetto | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Quercion petraeae | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Aceri tatarici-Quercion | 0.5 | 0.8 | 0.1 | 0.2 | 0.3 | 0.7 | 0.1 | 1.7 | 0.0 | 0.0 | 0.2 |
| Quercetalia cerridis s. l. | 0.6 | 1.2 | 0.1 | 0.4 | 0.5 | 1.6 | 0.1 | 1.8 | 0.0 | 0.1 | 0.2 |
Table 3 (continued)

| Percentage of characteristic species in K% | Percentage of characteristic species in A-D |
|------------------------------------------|------------------------------------------|
|                                          | Fr-A | V-Fr | O-B | M-A | M-S | Fr-U | Fr-A | V-Fr | O-B | M-A | M-S | Fr-U |
| Prunetalia spinosae                      | 0.0  | 1.1  | 1.1 | 1.2 | 0.5 | 0.4  | 0.0  | 0.2  | 0.1 | 0.6 | 0.1 | 0.0 |
| Berberidion                               | 0.1  | 0.2  | 0.0 | 0.1 | 0.0 | 0.1  | 0.0  | 0.1  | 0.0 | 0.0 | 0.0 | 0.0 |
| Prunion fruticosae                        | 0.0  | 0.5  | 0.7 | 0.8 | 0.3 | 0.2  | 0.0  | 0.1  | 0.1 | 0.2 | 0.0 | 0.0 |
| Prunetalia spinosae s. l.                | 0.1  | 1.8  | 1.8 | 2.1 | 0.8 | 0.7  | 0.0  | 0.4  | 0.2 | 0.8 | 0.1 | 0.0 |
| Quercetalia pubescentis-petraeae s. l.   | 1.8  | 17.1 | 13.2| 11.5| 8.2 | 15.9 | 0.2  | 24.1 | 12.6| 7.5 | 1.9 | 22.4|
| Querco-Fagea s. l.                       | 49.1 | 62.7 | 48.0| 40.4| 33.5| 76.9 | 65.0 | 92.3 | 54.4| 69.6| 52.3| 95.0|
| Abieti-Piceea                            | 0.0  | 0.0  | 0.0 | 0.1 | 0.0 | 0.1  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 |
| Vaccinio-Piceetea                        | 0.1  | 0.0  | 0.0 | 0.0 | 0.0 | 0.1  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 |
| Pino-Quercetalia                         | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 |
| Pino-Quercion                            | 0.4  | 0.6  | 2.0 | 0.9 | 0.6 | 0.2  | 0.0  | 0.1  | 11.5| 0.2 | 0.1 | 0.0 |
| Pino-Quercetalia s. l.                   | 0.4  | 0.6  | 2.0 | 0.9 | 0.6 | 0.2  | 0.0  | 0.1  | 11.5| 0.2 | 0.1 | 0.0 |
| Vaccinio-Piceetea s. l.                  | 0.5  | 0.6  | 2.0 | 0.9 | 0.6 | 0.3  | 0.0  | 0.1  | 11.5| 0.2 | 0.1 | 0.0 |
| Abieti-Piceea                            | 0.5  | 0.6  | 2.0 | 1.0 | 0.6 | 0.4  | 0.0  | 0.1  | 11.5| 0.2 | 0.1 | 0.0 |
| Lemno-Potamea                            | 1.2  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.1  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 |
| Hydrochari-Lemnetea                      | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 |
| Hydrocharieltalia                        | 0.8  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.1  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 |
| Lemnion minoris                          | 0.8  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.1  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 |
| Hydrocharieltalia s. l.                  | 1.6  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.2  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 |
| Hydrochari-Lemnetea s. l.                | 1.6  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.2  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 |
| Potamea                                  | 0.4  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 |
| Lemno-Potamea s. l.                      | 3.2  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.3  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 |
Table 3 (continued)

| Percentage of characteristic species in K% | Percentage of characteristic species in A-D |
|------------------------------------------|------------------------------------------|
|                                           | Fr-A       V-Fr   O-B    M-A   M-S   Fr-U | Fr-A       V-Fr   O-B    M-A   M-S   Fr-U |
| Cypero-Phragmitea                        | 0.0        0.0    0.0    0.0    0.0    0.0    0.0        0.0    0.0    0.0    0.0    0.0    0.0    0.0 |
| Phragmiteta                              | 11.6       2.6    1.4    5.2    7.5    0.4    8.8        0.4    0.5    3.4    16.6   0.0    0.0 |
| Phragmitetalia                           | 0.0        0.0    0.0    0.0    0.0    0.0    0.0        0.0    0.0    0.0    0.0    0.0    0.0 |
| Phragmition                              | 1.3        0.0    0.0    0.2    0.1    0.0    0.6        0.0    0.0    0.1    0.0    0.0   0.0 |
| Phragmitetalia s. l.                    | 1.3        0.0    0.0    0.2    0.1    0.0    0.6        0.0    0.0    0.1    0.0    0.0 |
| Nasturtio-Glycerietalia                  | 0.0        0.0    0.0    0.0    0.0    0.0    0.0        0.0    0.0    0.0    0.0    0.0 |
| Glycerio-Sparganion                      | 1.0        0.1    0.0    0.3    0.0    0.0    0.1        0.0    0.0    0.0    0.0    0.0 |
| Nasturtio-Glycerietalia s. l.            | 1.0        0.1    0.0    0.3    0.0    0.0    0.1        0.0    0.0    0.0    0.0    0.0 |
| Magnocaricetalia                         | 0.0        0.0    0.0    0.0    0.0    0.0    0.0        0.0    0.0    0.0    0.0 |
| Magnocaricion                            | 3.6        2.5    1.6    3.6    5.7    0.1    7.0        0.4    0.7    1.4    2.2    0.0 |
| Caricenion rostratae                     | 0.0        0.0    0.0    0.5    1.9    0.0    0.0        0.0    0.0    0.1    0.8    0.0 |
| Caricenion gracilis                      | 1.5        0.3    0.2    0.3    1.3    0.0    6.0        0.1    0.4    0.7    0.9    0.0 |
| Magnocaricion s. l.                      | 5.1        2.8    1.8    4.4    8.9    0.1    13.0       0.5    1.1    2.2    3.9    0.0 |
| Magnocaricetalia s. l.                   | 5.1        2.8    1.8    4.4    8.9    0.1    13.0       0.5    1.1    2.2    3.9    0.0 |
| Phragmitetalia s. l.                     | 19.0       5.5    3.2    10.1   16.5   0.5    22.5       0.9    1.6    5.7    20.5   0.0 |
| Isoëto-Nanojuncetea                      | 0.0        0.0    0.0    0.0    0.0    0.0    0.0        0.0    0.0    0.0    0.0 |
| Nanocyperetalia                          | 0.0        0.0    0.0    0.0    0.0    0.0    0.0        0.0    0.0    0.0    0.0 |
| Nanocyperion flavescentis                | 0.7        0.0    0.1    0.3    0.7    0.0    0.1        0.0    0.1    0.1    0.1 |
| Nanocyperetalia s. l.                    | 0.7        0.0    0.1    0.3    0.7    0.0    0.1        0.0    0.1    0.1 |
| Isoëto-Nanojuncetea s. l.                | 0.7        0.0    0.1    0.3    0.7    0.0    0.1        0.0    0.1 |
| Cypero-Phragmitea s. l.                  | 19.7       5.5    3.3    10.4   17.2   0.5    22.6       0.9    1.6    5.8    20.6   0.0 |
Table 3 (continued)

| Percentage of characteristic species in K% | Percentage of characteristic species in A-D |
|-------------------------------------------|-------------------------------------------|
| Fr-A | V-Fr | O-B | M-A | M-S | Fr-U | Fr-A | V-Fr | O-B | M-A | M-S | Fr-U |
|-------------------------------------------|-------------------------------------------|
| Oxycocco-Caricea nigrae                   | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Scheuchzerio-Caricetalia nigrae          | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Scheuchzerio-Caricetalia nigrae s. l.    | 0.3 | 0.0 | 0.2 | 0.2 | 0.3 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.0 |
| Oxycocco-Caricea nigrae s. l.            | 0.3 | 0.0 | 0.2 | 0.2 | 0.3 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.0 |
| Molinio-Arrhenatheraea                   | 1.4 | 4.0 | 5.4 | 4.9 | 8.3 | 1.5 | 0.1 | 0.7 | 0.8 | 1.8 | 0.3 |
| Molinio-Juncetea                         | 3.8 | 2.3 | 4.7 | 8.3 | 10.8 | 0.4 | 5.8 | 0.9 | 22.6 | 11.8 | 7.5 |
| Tofieldietalia                           | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Caricion davallianae                     | 0.0 | 0.0 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Tofieldietalia s. l.                     | 0.0 | 0.0 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Molinietalia coeruleae                   | 1.7 | 2.2 | 2.0 | 2.3 | 3.2 | 0.3 | 0.3 | 0.3 | 0.5 | 1.1 | 0.0 |
| Molinion coeruleae                       | 0.0 | 0.1 | 0.4 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 |
| Deschampion caespitosae                  | 0.9 | 0.4 | 0.4 | 1.2 | 3.5 | 0.1 | 0.2 | 0.2 | 0.7 | 2.4 | 2.8 |
| Filipendulo-Cirsion oleracei             | 0.0 | 1.7 | 0.6 | 1.1 | 0.9 | 0.3 | 0.0 | 0.3 | 0.1 | 0.2 | 0.3 |
| Alopecurion pratensis                    | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Molinietalia coeruleae s. l.             | 2.7 | 4.4 | 3.4 | 5.0 | 7.7 | 0.7 | 0.5 | 0.8 | 1.2 | 3.2 | 4.2 |
| Molinio-Juncetea s. l.                   | 6.5 | 6.7 | 8.2 | 13.5 | 18.5 | 1.1 | 6.3 | 1.7 | 23.8 | 15.0 | 11.7 |
| Arrhenatheretea                          | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Arrhenatheretalia                        | 0.0 | 0.4 | 0.6 | 0.3 | 0.3 | 0.3 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
| Arrhenatherion elatioris                 | 0.0 | 0.4 | 0.6 | 0.4 | 0.4 | 0.0 | 0.0 | 0.0 | 0.2 | 0.1 | 0.1 |
| Cynosurion cristati                      | 0.0 | 0.0 | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
Table 3 (continued)

|                         | Percentage of characteristic species in K% | Percentage of characteristic species in A-D |
|-------------------------|-------------------------------------------|--------------------------------------------|
|                         | Fr-A | V-Fr | O-B | M-A | M-S | Fr-U | Fr-A | V-Fr | O-B | M-A | M-S | Fr-U |
| Arrhenatheretalia s. l. | 0.0  | 0.8  | 1.5 | 0.8 | 0.7 | 0.3  | 0.0  | 0.0  | 0.1 | 0.1 | 0.0 |
| Arrhenatheretea s. l.  | 0.0  | 0.8  | 1.5 | 0.8 | 0.7 | 0.3  | 0.0  | 0.0  | 0.1 | 0.1 | 0.0 |
| Nardo-Callunetea       | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 |
| Nardetalia             | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 |
| Nardo-Agrostion tenuis | 0.0  | 0.4  | 0.5 | 0.5 | 0.0 | 0.2  | 0.0  | 0.0  | 0.1 | 0.1 | 0.3 |
| Nardetalia s. l.       | 0.0  | 0.4  | 0.5 | 0.5 | 0.0 | 0.2  | 0.0  | 0.0  | 0.1 | 0.1 | 0.3 |
| Nardo-Callunetea s. l. | 0.0  | 0.4  | 0.5 | 0.5 | 0.0 | 0.2  | 0.0  | 0.0  | 0.1 | 0.1 | 0.3 |
| Calluno-Ulicetea       | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 |
| Vaccinio-Genistetalia  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 |
| Calluno-Genistion      | 0.0  | 0.0  | 0.0 | 0.1 | 0.0 | 0.2  | 0.0  | 0.0  | 0.0 | 0.0 | 0.3 |
| Vaccinio-Genistetalia s. l. | 0.0  | 0.0  | 0.0 | 0.1 | 0.0 | 0.2  | 0.0  | 0.0  | 0.0 | 0.0 | 0.3 |
| Calluno-Ulicetea s. l. | 0.0  | 0.0  | 0.0 | 0.1 | 0.0 | 0.2  | 0.0  | 0.0  | 0.0 | 0.0 | 0.3 |
| Molinio-Arrhenatherea s. l. | 7.9  | 11.9 | 15.6 | 19.8 | 27.5 | 3.3  | 6.4  | 2.4  | 24.9 | 16.0 | 13.6 | 0.9 |
| Puccinellio-Salicornia  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 |
| Festuco-Puccinellietea | 0.1  | 0.0  | 0.4 | 0.2 | 0.8 | 0.0  | 0.1  | 0.0  | 0.7 | 1.1 | 0.0 |
| Festuco-Puccinellietalia | 0.6  | 0.2  | 0.3 | 0.5 | 0.8 | 0.0  | 0.1  | 0.0  | 0.1 | 0.1 | 0.0 |
| Juncion gerardi        | 0.0  | 0.0  | 0.1 | 0.1 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 |
| Beckmannion eruciformis| 0.0  | 0.0  | 0.0 | 0.1 | 0.5 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.2 |
| Festuco-Puccinellietalia s. l. | 0.7  | 0.2  | 0.4 | 0.7 | 1.3 | 0.0  | 0.2  | 0.0  | 0.0 | 0.1 | 0.3 |
| Artemisio-Festucetalia pseudovinae | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 |
| Festucion pseudovinae  | 0.0  | 0.0  | 0.0 | 0.0 | 0.1 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 |
Table 3 (continued)

| Percentage of characteristic species in K% | Percentage of characteristic species in A-D |
|-------------------------------------------|------------------------------------------|
| Fr-A | V-Fr | O-B | M-A | M-S | Fr-U | Fr-A | V-Fr | O-B | M-A | M-S | Fr-U |
| Artemisio-Festucetalia pseudovinae s. l. | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Festuco-Puccinellietea s. l. | 0.0 | 0.2 | 0.8 | 0.9 | 2.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.8 | 1.4 | 0.0 |
| Puccinellio-Salicornea s. l. | 0.7 | 0.2 | 0.8 | 0.9 | 2.2 | 0.0 | 0.2 | 0.0 | 0.0 | 0.8 | 1.4 | 0.0 |
| Festuco-Bromea | 0.0 | 0.2 | 0.5 | 0.3 | 0.5 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 | 0.0 |
| Festucetalia vaginatae | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Festucetalia vaginatae | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Festucetalia vaginatae | 0.0 | 0.1 | 0.0 | 0.9 | 0.9 | 0.0 | 0.0 | 0.0 | 0.1 | 0.4 | 0.0 |
| Festucetalia vaginatae | 0.0 | 0.1 | 0.0 | 0.9 | 0.9 | 0.0 | 0.0 | 0.0 | 0.1 | 0.4 | 0.0 |
| Festucetalia vaginatae s. l. | 0.0 | 0.1 | 0.0 | 0.9 | 0.9 | 0.0 | 0.0 | 0.0 | 0.1 | 0.4 | 0.0 |
| Festucetalia vaginatae | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Festucetalia valesiaceae | 0.0 | 0.2 | 0.2 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 |
| Festucetalia valesiaceae | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Festucion rupicola | 0.0 | 0.0 | 0.6 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 |
| Cynodonto-Festucenion | 0.0 | 0.0 | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Festucion rupicola s. l. | 0.0 | 0.0 | 1.2 | 0.7 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 |
| Festucion rupicola s. l. | 0.0 | 0.0 | 1.4 | 0.9 | 0.5 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.0 |
| Festucetalia valesiaceae | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Brometalia erecti | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Cirso-Brachypodion | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Brometalia erecti s. l. | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Festuco-Bromea | 0.0 | 0.6 | 3.1 | 2.1 | 1.3 | 0.2 | 0.0 | 0.1 | 0.5 | 0.3 | 0.2 | 0.0 |
| Festuco-Bromea s. l. | 0.0 | 0.9 | 3.6 | 3.3 | 2.7 | 0.2 | 0.0 | 0.1 | 0.6 | 0.4 | 0.7 | 0.0 |
Table 3 (continued)

| Species                      | Fr-A | V-Fr | O-B | M-A | M-S | Fr-U | Fr-A | V-Fr | O-B | M-A | M-S | Fr-U |
|------------------------------|------|------|-----|-----|-----|------|------|------|-----|-----|-----|------|
| Chenopodio-Scleranthea       | 0.5  | 0.6  | 1.0 | 1.1 | 0.9 | 0.2  | 0.0  | 0.1  | 0.1 | 0.2 | 0.2 | 0.0  |
| Secalietea                   | 0.5  | 0.9  | 0.3 | 0.9 | 0.8 | 0.6  | 0.0  | 0.2  | 0.0 | 0.1 | 0.1 | 0.1  |
| Oryzetea sativae             | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Oryzetalia                   | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Oryzion sativae              | 0.3  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Oryzeta s. l.                | 0.3  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Oryzeta sativae s. l.        | 0.3  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Chenopodietea                | 0.1  | 0.2  | 1.0 | 0.7 | 0.1 | 0.5  | 0.0  | 0.0  | 0.1 | 0.1 | 0.0 | 0.1  |
| Onopordetalia                | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Onopordion acanthii          | 0.0  | 0.0  | 0.7 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.1 | 0.0 | 0.0 | 0.0  |
| Onopordetalia s. l.          | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.1 | 0.0 | 0.0 | 0.0  |
| Chenopodietea s. l.          | 0.0  | 0.2  | 1.7 | 0.7 | 0.1 | 0.0  | 0.0  | 0.0  | 0.2 | 0.1 | 0.0 | 0.0  |
| Artemisietea                 | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Artemisietalia               | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Arction lappae               | 0.5  | 0.8  | 1.6 | 1.0 | 0.0 | 1.1  | 0.1  | 0.1  | 0.2 | 0.2 | 0.0 | 0.1  |
| Artemisietalia s. l.         | 0.5  | 0.8  | 1.6 | 1.0 | 0.0 | 1.1  | 0.1  | 0.1  | 0.2 | 0.2 | 0.0 | 0.1  |
| Artemisietea s. l.           | 0.5  | 0.8  | 1.6 | 1.0 | 0.0 | 1.1  | 0.1  | 0.1  | 0.2 | 0.2 | 0.0 | 0.1  |
| Galio-Urticetea              | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Calystegietalia sepium        | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Galio-Alliarion               | 0.4  | 2.3  | 3.6 | 1.8 | 0.0 | 3.9  | 0.1  | 0.4  | 0.6 | 0.4 | 0.0 | 0.6  |
**Table 3 (continued)**

| Percentage of characteristic species in K% | Percentage of characteristic species in A-D |
|------------------------------------------|-------------------------------------------|
|                                          | Fr-A | V-Fr | O-B | M-A | M-S | Fr-U | Fr-A | V-Fr | O-B | M-A | M-S | Fr-U |
| Calystegion sepium                       | 5.0  | 1.5  | 1.2 | 2.5 | 1.9 | 0.9  | 3.1  | 0.5  | 0.2 | 0.8 | 2.3 | 0.1  |
| Calystegietalia sepium s. l.             | 5.4  | 3.8  | 4.8 | 4.3 | 1.9 | 4.8  | 3.2  | 0.9  | 0.8 | 1.2 | 2.3 | 0.7  |
| Galio-Urticetea s. l.                    | 5.4  | 3.8  | 4.8 | 4.3 | 1.9 | 4.8  | 3.2  | 0.9  | 0.8 | 1.2 | 2.3 | 0.7  |
| Bidentetalia                             | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Bidentetalia                             | 3.1  | 0.8  | 0.4 | 1.8 | 1.7 | 0.5  | 0.9  | 0.2  | 0.1 | 0.5 | 0.6 | 0.0  |
| Bidetion tripartiti                      | 0.7  | 0.0  | 0.0 | 0.2 | 0.1 | 0.0  | 0.2  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Chenopodion rubri                        | 0.3  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Bidentetalia s. l.                       | 4.1  | 0.8  | 0.4 | 2.0 | 1.8 | 0.5  | 1.1  | 0.2  | 0.1 | 0.5 | 0.6 | 0.0  |
| Bidentetalia s. l.                       | 4.1  | 0.8  | 0.4 | 2.0 | 1.8 | 0.5  | 1.1  | 0.2  | 0.1 | 0.5 | 0.6 | 0.0  |
| Plantaginetea                            | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Plantaginietalia majoris                 | 0.5  | 0.3  | 0.9 | 1.0 | 1.0 | 0.2  | 0.1  | 0.0  | 0.1 | 0.3 | 0.3 | 0.0  |
| Agropyro-Rumicion crispil                | 0.0  | 0.0  | 0.0 | 0.2 | 0.1 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Plantaginetalia majoris s. l.            | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Plantaginetalia s. l.                    | 0.5  | 0.3  | 0.9 | 1.2 | 1.1 | 0.2  | 0.1  | 0.0  | 0.1 | 0.3 | 0.3 | 0.0  |
| Epilobieta angustifolii                  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Epilobieta angustifolii                  | 1.8  | 4.5  | 5.7 | 2.3 | 0.9 | 6.1  | 0.2  | 0.8  | 1.6 | 0.7 | 0.2 | 1.4  |
| Epilobieta angustifolii                  | 0.0  | 0.1  | 0.0 | 0.0 | 0.0 | 0.2  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
| Epilobieta angustifolii s. l.            | 1.8  | 4.6  | 5.7 | 2.3 | 0.9 | 6.3  | 0.2  | 0.8  | 1.6 | 0.7 | 0.2 | 1.4  |
| Epilobieta angustifolii s. l.            | 1.8  | 4.6  | 5.7 | 2.3 | 0.9 | 6.3  | 0.2  | 0.8  | 1.6 | 0.7 | 0.2 | 1.4  |
| Urtico-Sambucetee                         | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  | 0.0  | 0.0  | 0.0 | 0.0 | 0.0 | 0.0  |
The frequency distribution of species in the five constancy categories, from I to V, follows a characteristic pattern. The highest frequency value at I steeply drops to II, then decreases further with diminishing increments to IV, where it reaches its minimum. At V, its value is again higher (Fig. 4). This pattern is only typical of phytosociological samples that are representative of the sampled vegetation unit (see Kevey 2008).

Proportion of character species

As usual in temperate deciduous forests in Central Europe, the species characteristic of the Querco-Fagetea class or syntaxa within it play a substantial role (30.8%) in the species composition of these *Fraxinus angustifolia* dominated stands. They are followed by the character species of SE European dry oak woods, Quercetea pubescentis-petraeae s. l. (17.1%) despite the rather mesic habitat, and Alnetea glutinosae s. l., Molinio-Juncetea s. l., and Phragmitetea s. l. in decreasing order. Within the Querco-Fagetea class, Fageta s. l. and Alnion incanae species attain the highest proportions.

In comparison to other communities, it is noteworthy that character species proportions in all but two syntaxa were typically intermediate between those in *Fraxino pannonicae-Alnetum* and

| Percentage of characteristic species in K% | Fr-A | V-Fr | O-B | M-A | M-S | Fr-U | O-B | V-Fr | O-B | M-A | M-S | Fr-U |
|------------------------------------------|------|------|-----|-----|-----|------|-----|------|-----|-----|-----|------|
| Sambucelatia capreae                     | 0.1  | 0.3  | 0.6 | 0.3 | 0.1 | 0.1  | 0.3 | 0.1  | 0.3 | 0.3 | 0.1 | 0.3  |
| Sambuccetalia s. l.                      | 0.1  | 0.3  | 0.6 | 0.3 | 0.1 | 0.1  | 0.3 | 0.1  | 0.3 | 0.3 | 0.1 | 0.3  |
| Sambuco-Salicion capreae                 | 13.8 | 17.0 | 7.5 | 14.6| 4.7 | 2.3  | 4.7 | 2.3  | 4.7 | 2.3 | 4.7 | 2.3  |
| Chenopodio-Scleranthea s. l.             | 3.6  | 3.8  | 4.7 | 4.9 | 5.9 | 2.9  | 4.9 | 2.9  | 4.9 | 2.9 | 4.9 | 2.9  |
| Indifferens                              | 0.5  | 1.9  | 4.9 | 2.4 | 1.0 | 1.1  | 0.8 | 0.4  | 0.1 | 0.0 | 0.0 | 0.8  |
| Adventiva                                | 0.5  | 1.9  | 4.9 | 2.4 | 1.0 | 1.1  | 0.8 | 0.4  | 0.1 | 0.0 | 0.0 | 0.8  |
Table 4
Differential species in *Veratro albi-Fraxinetum angustifoliae* and *Fraxino pannonicae-Alnetum*

| Species                      | V-Fr | Fr-A | V-Fr | Fr-A |
|------------------------------|------|------|------|------|
| **Constant species**         |      |      |      |      |
| *Crataegus monogyna*         | V    | –    | VI   | –    |
| *Euonymus europaeus*         | V    | –    | VI   | –    |
| *Filipendula ulmaria*        | V    | –    | VI   | –    |
| *Geum urbanum*               | V    | –    | VI   | –    |
| *Ligustrum vulgare*          | V    | –    | VI   | –    |
| *Lychnis flos-cuculi*        | V    | –    | VI   | –    |
| *Rhamnus catharticus*        | V    | –    | VI   | –    |
| *Scrophularia nodosa*        | V    | –    | VI   | –    |
| *Torilis japonica*           | V    | –    | VI   | –    |
| *Veratrum album*             | V    | I    | VI   | –    |
| *Angelica sylvestris*        | V    | I    | VI   | –    |
| *Equisetum arvense*          | V    | I    | VI   | –    |
| *Galium aparine*             | V    | I    | VI   | –    |
| *Brachypodium sylvaticum*    | V    | II   | VI   | –    |
| *Cornus sanguinea*           | V    | II   | VI   | –    |
| *Lysimachia nummularia*      | V    | II   | VI   | –    |
| *Viburnum opulus*            | V    | II   | VI   | –    |
| **Sub-constant species**     |      |      |      |      |
| *Cucubalus baccifer*         | IV   | –    |      |      |
| **Equisetum arvense**        |      |      | V    | –    |
| **Galium aparine**           |      |      | V    | –    |
| **Brachypodium sylvaticum**  |      |      | V    | –    |
| **Cornus sanguinea**         |      |      | V    | –    |
| **Lysimachia nummularia**    |      |      | V    | –    |
| **Viburnum opulus**          |      |      | V    | –    |
| **Frangula alnus**           |      |      | V    | III  |
| **Populus alba**             |      |      | V    | III  |
| **Alnus glutinosa**          | –    | V    | –    | V    |
| **Lemna minor**              | –    | V    | –    | V    |
| **Oenanthe aquatica**        | –    | V    | –    | V    |
| **Salix cinerea**            | –    | V    | –    | V    |
| **Carex riparia**            | I    | V    | –    | V    |
| **Galium palustre**          | I    | V    | –    | V    |
| **Lycopus europaeus**        | II   | V    | –    | V    |
| **Salix fragilis**           | II   | V    | –    | V    |
| **Solanum dulcamara**        | II   | V    | –    | V    |
| **Symphytum officinale**     | II   | V    | –    | V    |
| **Carex acutiformis**        | III  | V    | –    | V    |

**DRAINED ASH SWAMP IN THE NYÍRSÉG, NE HUNGARY**

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Table 4 (continued)

|                  | V-Fr | Fr-A |                  | V-Fr | Fr-A |
|------------------|------|------|------------------|------|------|
| Sambucus nigra   | III  | I    | Hypericum tetapterum | II  | –    |
| Bidens tripartita| –    | III  | Polygonatum latifolium | II  | –    |
| Carex vesicaria  | –    | III  | Pulmonaria mollissima | II  | –    |
| Glyceria maxima  | –    | III  | Ranunculus auricomus agg. | II  | –    |
| Impatiens noli-tangere | – | III  | Rosa canina agg. | II  | –    |
| Lythrum salicaria| –    | III  | Rumex sanguineus | II  | –    |
| Salix alba       | –    | III  | Stachys sylvatica | II  | –    |
| Sub-accessorial species |      |      | Vicia cracca | II  | –    |
| Acer tataricum   | II   | –    | Chenopodium polyspermum | – | II  |
| Alliaria petiolata| II  | –    | Myosotis nemorosa | – | II  |
| Angelica palustris| II  | –    | Persicaria hydropiper | – | II  |
| Campanula glomerata| II | –    | Poa palustris | – | II  |
| Campanula trachelium| II | –    | Scutellaria galericulata | – | II  |
| Carex michelii   | II   | –    | Teucrium scordium | – | II  |
| Carex spicata    | II   | –    | Thelypteris palustris | – | II  |
| Carex sylvatica  | II   | –    | Typha latifolia | – | II  |
| Circaea lutetiana| II   | –    |                  |      |      |
| Cirsiurn rivulare| II   | –    |                  |      |      |
| Crucita glabra   | II   | –    |                  |      |      |
| Fraxinus pennsylvanica | II | –    |                  |      |      |
| Galium mollugo   | II   | –    |                  |      |      |
| Heracleum sphondylium | II | –    |                  |      |      |

Number of differential species: 68, 32

Fig. 10. Proportion of Molinio-Juncetea s. l. character species. Fr-A = Fraxino pannoniccae-Alnetum, Nyírség (Kevey and Papp L. ined.: 5 relevés); V-Fr = Veratro albi-Fraxinetum angustifoliiæ, Nyírség (Kevey and Papp L. ined.: 10 relevés); Fr-U = Fraxino pannoniccae-Ulmetum, Nyírség (Kevey et al. 2017: 20 relevés)
### Table 5
Differential species in *Veratro albi-Fraxinetum angustifoliae* and *Fraxino pannonicae-Ulmetum*

| Constant species                                      | V-Fr | Fr-U | V-Fr | Fr-U |
|--------------------------------------------------------|------|------|------|------|
| Angelica sylvestris                                   | V    | –    |     |      |
| Equisetum arvense                                     | V    | –    |     |      |
| Filipendula ulmaria                                   | V    | I    |     |      |
| Lychnis flos-cuculi                                   | V    | I    |     |      |
| Eupatorium cannabinum                                 | V    | I    |     |      |
| Frangula alnus                                         | V    | I    |     |      |
| Veratrum album                                         | V    | I    |     |      |
| Rhamnus catharticus                                   | V    | II   |     |      |
| Lysimachia nummularia                                 | V    | III  |     |      |
| Populus alba                                           | V    | III  |     |      |
| Viburnum opulus                                        | V    | III  |     |      |
| Ranunculus ficaria                                     | –    | V    |     |      |
| Viola reichenbachiana                                  | –    | V    |     |      |
| Acer campestre                                         | I    | V    |     |      |
| Milium effusum                                         | I    | V    |     |      |
| Polygonatum multiflorum                                | I    | V    |     |      |
| Ajuga reptans                                          | II   | V    |     |      |
| Circaea lutetiana                                      | II   | V    |     |      |
| Stachys sylvatica                                      | II   | V    |     |      |
| Chaerophyllum temulum                                  | III  | V    |     |      |
| Convallaria majalis                                    | III  | V    |     |      |
| Corylus avellana                                       | III  | V    |     |      |
| Geranium robertianum                                   | III  | V    |     |      |
| Sambucus nigra                                         | III  | V    |     |      |
| Sub-constant species                                   |      |      |      |      |
| Geranium palustre                                      | IV   | –    |     |      |
| Valeriana officinalis                                  | IV   | –    |     |      |
| Glechoma hederacea                                     | IV   | I    |     |      |
| Poa trivialis                                          | IV   | I    |     |      |
| Prunus spinosa                                         | IV   | I    |     |      |
| Pyrus pyraster                                         | IV   | I    |     |      |

| Accessorial species                                    |      |      |      |      |
| Taraxacum officinale agg.                             | IV   | I    |     |      |
| Chelidonium majus                                      | –    | IV   |     |      |
| Pulmonaria officinalis                                | –    | IV   |     |      |
| Carpinus betulus                                      | I    | IV   |     |      |
| Lapsana communis                                      | I    | IV   |     |      |
| Ulmus laevis                                          | I    | IV   |     |      |
| Veronica hederifolia subsp. lucorum                   | I    | IV   |     |      |
| Viola mirabilis                                       | I    | IV   |     |      |
| Alliaria petiolata                                    | II   | IV   |     |      |
| Carex sylvatica                                       | II   | IV   |     |      |
| Festuca gigantea                                      | II   | IV   |     |      |
| Betonica officinalis                                  | III  | –    |     |      |
| Carex acutiformis                                     | III  | –    |     |      |
| Cirsium canum                                         | III  | –    |     |      |
| Iris pseudacorus                                      | III  | –    |     |      |
| Ophioglossum vulgatum                                 | III  | –    |     |      |
| Trollius europae                                       | III  | –    |     |      |
| Clinopodium vulgare                                   | III  | I    |     |      |
| Deschampsia caespitosa                                | III  | I    |     |      |
| Elymus caninus                                        | III  | I    |     |      |
| Populus tremula                                       | III  | I    |     |      |
| Actaea spicata                                        | –    | III  |     |      |
| Bromus ramosus agg.                                   | –    | III  |     |      |
| Fallopia dumetorum                                    | –    | III  |     |      |
| Hedera helix                                          | –    | III  |     |      |
| Lilium martagon                                       | –    | III  |     |      |
| Tilia cordata                                         | –    | III  |     |      |
| Tilia tomentosa                                        | –    | III  |     |      |
| Carex divulsa                                         | I    | III  |     |      |
| Carex remota                                          | I    | III  |     |      |

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### Table 5 (continued)

| Sub-accessorial species          | V-Fr | Fr-U |
|----------------------------------|------|------|
| Angelica palustris               | II   | –    |
| Campanula glomerata              | II   | –    |
| Carex michelii                   | II   | –    |
| Carex otrubae                    | II   | –    |
| Carex spicata                    | II   | –    |
| Cirsium rivulare                 | II   | –    |
| Galium mollugo                   | II   | –    |
| Hypericum tetragonatum           | II   | –    |
| Lycopus europaeus                | II   | –    |
| Pulmonaria mollissima            | II   | –    |
| Sium latifolium                  | II   | –    |
| Symphytum officinale             | II   | –    |
| Vicia cracca                     | II   | –    |
| Allium ursinum                   | –    | II   |
| Anemone ranunculoides            | –    | II   |
| Cerasus avium                    | –    | II   |

| Number of differential species   | 41   | 47   |

*V-Fr = Veratro albi-Fraxinetum angustifolii* (Kevey and Papp L. ined.: 10 rel.); *Fr-U = Fraxino pannonicae-Ulmetum, Nyírség* (Kevey and Papp L. ined.: 20 rel.)

### Table 6

**Differential species in Veratro albi-Fraxinetum angustifolii and Ophioglosso-Betuletum**

| Constant species               | V-Fr | O-B | V-Fr | O-B |
|--------------------------------|------|-----|------|-----|
| Cornus sanguinea               | V    | –   | Carex flacca | –  | V   |
| Filipendula ulmaria            | V    | –   | Chelidonium majus | –  | V   |
| Fraxinus angustifolia subsp. danubialis | V | –   | Circaes vitalba | –  | V   |
| Lychnis flos-cuculi            | V    | –   | Cynoglossum officinale | –  | V   |
| Lysimachia nummularia          | V    | –   | Dactylis glomerata | –  | V   |
| Scrophularia nodosa            | V    | –   | Fallopia dumetorum | –  | V   |
| Populus alba                   | V    | I   | Galium odoratum | –  | V   |
| Equisetum arvense              | V    | II  | Molinia coerulea | –  | V   |
| Galium aparine                 | V    | II  | Phragmites australis | –  | V   |
| Acer pseudo-platanus           | –    | V   | Quercus cerris | –  | V   |
| Arctium lappa                  | –    | V   | Ranunculus polyanthemos | –  | V   |
| Sanguisorba officinalis        | –    | V   |

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Table 6 (continued)

|                      | V-Fr | O-B |                      | V-Fr | O-B |
|----------------------|------|-----|----------------------|------|-----|
| Solidago gigantea    | –    | V   | Achillea millefolium | –    | IV  |
| Acer campestre       | I    | V   | Cardamine impatiens  | –    | IV  |
| Acer negundo         | I    | V   | Cerasus avium        | –    | IV  |
| Betula pubescens     | I    | V   | Festuca rubra        | –    | IV  |
| Galeopsis pubescens  | I    | V   | Alliaria petiolata   | II   | IV  |
| Lapsana communis     | I    | V   |                      |      |     |
| Lysimachia vulgaris  | I    | V   | Arctium minus        | III  | –   |
| Mycelis muralis      | I    | V   | Betonica officinalis | III  | –   |
| Ranunculus acris     | I    | V   | Cirsium canum        | III  | –   |
| Selinium carvifolia  | I    | V   | Clinopodium vulgare  | III  | –   |
| Serratula tinctoria   | I    | V   | Convallaria majalis  | III  | –   |
| Circaea lutetiana    | II   | V   | Corylus avellana     | III  | –   |
| Festuca gigantea     | II   | V   | Dactylis polygama    | III  | –   |
| Fraxinus pennsylvanica| II  | V   | Elymus caninus       | III  | –   |
| Galium mollugo       | II   | V   | Iris pseudacorus     | III  | –   |
| Humulus lupulus      | II   | V   | Populus tremula      | III  | –   |
| Rosa canina agg.     | II   | V   | Trollius europaeus    | III  | –   |
| Stachys sylvatica    | II   | V   | Veronica chamaedrys  | III  | –   |
| Carex acutiformis    | III  | V   | Agrimonia eupatoria  | –    | III |
| Chaerophyllum temulum| III  | V   | Colchicum autumnale  | –    | III |
| Deschampsia caespitosa| III | V   | Dianthus superbus    | –    | III |
| Geranium robertianum | III  | V   | Mentha pulegium      | –    | III |
| Ophioglossum vulgatum| III  | V   | Poa angustifolia     | –    | III |
| Sambucus nigra       | III  | V   | Rubus fruticosus agg.| –    | III |
| Urtica dioica        | III  | V   | Tussilago farfara    | –    | III |
|                      |      |     | Lathyrus pratensis   | I    | III |

Sub-constant species

|                      |      |     |                      |      |     |
|----------------------|------|-----|----------------------|------|-----|
| Geranium palustre    | IV   | –   |                      |      |     |
| Glechoma hederacea   | IV   | –   |                      |      |     |
| Listera ovata        | IV   | –   |                      |      |     |
| Ulmus minor          | IV   | –   |                      |      |     |
| Valeriana officinalis| IV   | –   |                      |      |     |
| Poa trivialis        | IV   | I   |                      |      |     |
| Quercus robur        | IV   | I   |                      |      |     |
| Prunus spinosa       | IV   | II  |                      |      |     |

Sub-accessorial species

|                      |      |     |                      |      |     |
|----------------------|------|-----|----------------------|------|-----|
| Acer tataricum       | II   | –   |                      |      |     |
| Ajuga reptans        | II   | –   |                      |      |     |
| Angelica palustris   | II   | –   |                      |      |     |
| Caltha palustris     | II   | –   |                      |      |     |
| Campanula glomerata  | II   | –   |                      |      |     |
| Campanula trachelium | II   | –   |                      |      |     |
| Cardamine pratensis  | II   | –   |                      |      |     |
Fraxino pannonicae-Ulmetum, which reflects the transitional habitat of *Veratrot albi-Fraxinetum angustifolii* between the former two (Table 3, Figs 5–10). The two exceptions are the Quercetea pubescentis-petraeae s. l. and Molino-Juncetea s. l. species. The proportion of the former is the highest not only among the three, but among all six communities, whereas that of the latter is the highest among the three hardwood riparian forest associations, but is the smallest among all drained swamp communities. The distribution of character species proportions in *Veratrot albi-Fraxinetum angustifolii* are rather different from the latter communities. The largest differences are found in the character species of Phragmitetea s. l., Molino-Juncetea s. l., Galio-Urticetea s. l., Epilobietea s. l., Salicetea purpureae s. l., Alnetea glutinosae s. l., Querco-Fagetea s. l., Fagetealia, Alnion incanae s. l. and Quercetea pubescentis-petraeae s. l. (Table 4).

The occurrence of introduced aliens (*Fraxinus pennsylvanica*, *Acer negundo*, *Celtis occidentalis*, *Echinocystis lobata*, *Parthenocissus inserta*, *Robinia pseudoacacia*, *Vitis riparia*) in the association is apparent (Table 1), but compared to other associations in the region, their proportion is low (1.9%).

**Number of differentiating species**

The number of differentiating species (species for which the difference between their constancy values in the compared two communities equals or exceeds two) in *Veratrot albi-Fraxinetum angustifolii* is greater than 40 in all pairwise comparisons. The highest number of differentiating species (68) was
### Differential species in *Veratro albi-Fraxinetum angustifoliae* and *Molinio-Alnetum glutinosae*

| Constant species | V-Fr | M-A | Sub-constant species | V-Fr | M-A |
|------------------|------|-----|----------------------|------|-----|
| *Filipendula ulmaria* | V    | –   | *Geranium palustre*  | IV   | –   |
| *Fraxinus angustifolia subsp. danubialis* | V    | –   | *Listera ovata*      | IV   | –   |
| *Scrophularia nodosa* | V    | –   | *Moehringia trinervia* | IV   | –   |
| *Lychnis flos-cuculi* | V I  |     | *Glechoma hederacea* | IV I  |     |
| *Torilis japonica* | V I  |     | *Ulmus minor*        | IV II |     |
| *Veratrum album* | V I  |     | *Pyrus pyraster*     | IV III|     |
| *Euonymus europaeus* | V II |     | *Asclepias syriaca*  | – IV  |     |
| *Populus alba* | V II |     | *Carex flacca*       | – IV  |     |
| *Gewm urbanum* | V III|     | *Cynoglossum hungaricum* | – IV  |     |
| *Ligustrum vulgare* | V III|     | *Equisetum palustre* | – IV  |     |
| *Lysimachia nummularia* | V III|     | *Lythrum salicaria*  | – IV  |     |
| *Viburnum opulus* | V III|     | *Phragmites australis* | – IV  |     |
| *Alnus glutinosa* | – V  |     | *Potentilla reptans* | – IV  |     |
| *Molinia coerulea* | – V  |     | *Ranunculus polyanthemos* | – IV  |     |
| *Poa pratensis* | – V  |     | *Sonchus palustris*  | – IV  |     |
| *Salix cinerea* | – V  |     | *Galium palustre*    | I IV  |     |
| *Sanguisorba officinalis* | – V  |     | *Mentha aquatica*    | I IV  |     |
| *Solidago gigantea* | – V  |     | *Selinum carvifolia* | I IV  |     |
| *Valeriana dioica* | – V  |     | *Stachys palustris*  | I IV  |     |
| *Calystegia sepium* | I V  |     | *Caltha palustris*   | II IV |     |
| *Celtis occidentalis* | I V  |     | *Rosa canina agg.*   | II IV |     |
| *Lysimachia vulgaris* | I V  |     | *Clinopodium vulgare* | III – |     |
| *Ranunculus acris* | I V  |     | *Convallaria majalis* | III – |     |
| *Lycopus europaeus* | II V  |     | *Corylus avellana*   | III – |     |
| *Ranunculus repens* | II V  |     | *Trollius europaeus* | III – |     |
| *Solanum dulcamara* | II V  |     | *Betonica officinalis* | III I  |     |
| *Vicia cracca* | II V  |     | *Dactylis polygama*  | III I  |     |
| *Carex acutiformis* | III V |     | *Elymus caninus*     | III I  |     |
| *Cirsium canum* | III V |     | *Ophioglossum vulgatum* | III I  |     |
| *Deschampsia caespitosa* | III V |     | *Veronica chamaedrys* | III I  |     |
| *Iris pseudacorus* | III V |     | *Carex elata*        | – III |     |
| *Sambucus nigra* | III V |     |                        |       |     |
found in the comparison to the alder swamp (*Fraxino-Alnetum glutinosae*), whereas the smallest number (41) occurred in relation to *Fraxino pannonicae-Ulmetum* (Tables 5–8).

**Number of protected species**

The stands of *Veratro albi-Fraxinetum angustifoliae* host numerous rare, threatened, or otherwise protected plant species. These are: *Veratrum album* (K: V), *Listera ovata* (K: IV) *Ophioglossum vulgatum*, *Trollius europaeus* (both

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**Table 7 (continued)**

| V-Fr | M-A | V-Fr | M-A |
|------|------|------|------|
| *Galium boreale* | – | III | *Allium angulosum* | – | II |
| *Galium verum* | – | III | *Bromus sterilis* | – | II |
| *Genista tinctoria subsp. elata* | – | III | *Carex paniculata* | – | II |
| *Phalaris arundinacea* | – | III | *Cirsium arvense* | – | II |
| *Euphorbia palustris* | I | III | *Cirsium vulgare* | – | II |
| *Succisa pratensis* | I | III | *Dactylis glomerata* | – | II |
|  |  |  | *Festuca pratensis* | – | II |
|  |  |  | *Gentiana pneumonanthe* | – | II |
|  |  |  | *Iris sibirica* | – | II |
|  |  |  | *Leucojum aestivum* | – | II |
|  |  |  | *Morus alba* | – | II |
|  |  |  | *Padus serotina* | – | II |
|  |  |  | *Phytolacca americana* | – | II |
|  |  |  | *Pulicaria dysenterica* | – | II |
|  |  |  | *Salix alba* | – | II |
|  |  |  | *Salix rosmarinifolia* | – | II |
|  |  |  | *Scirpoides holoschoenus* | – | II |
|  |  |  | *Scutellaria galericulata* | – | II |
|  |  |  | *Thalictrum flavum* | – | II |
|  |  |  | *Trifolium montanum* | – | II |
|  |  |  |  | Number of differential species 43 63 |

V-Fr = *Veratro albi-Fraxinetum angustifoliae* (Kevey and Papp L. ined.: 10 rel.); M-A = *Molinio-Alnetum glutinosae*, Mezőföld (Kevey 2008: 20 rel.)
K: III), *Betula pubescens*, *Cephalanthera damasonium*, *C. longifolia*, *Epipactis hel-leborine agg.*, *Equisetum hyemale* (incl. *Equisetum × moorei*), *Orchis militaris*, *Pla-tanthera bifolia* (all K: I).

**Similarity relations in multivariate analyses**

In the cluster analysis with complete linkage algorithm, the ten samples of *Veratro albi-Fraxinetum angustifoliae* grouped with the samples of *Fraxino pannonicae-Ulmetum*. The rest of the samples formed the sister cluster of this group. In this cluster, samples of the alder swamp (*Fraxino pannonicae-Alnetum*) were the sister cluster of the three drained swamp communities (*Ophioglosso-Betuletum pubescentis*, *Molinio-Alnetum*, *Molinio-Salicetum cinereae*) (Fig. 11). The result in the analysis with the group-average algorithm differed only in the placement of one of the drained swamp communities (*Ophioglosso-Betuletum*...)

![Binary dendrogram of alder swamp, hardwood riparian forest and drained swamp communities I (method: complete link; coefficient: Baroni-Urbani and Buser).](image-url)

*Fig. 11.* Binary dendrogram of alder swamp, hardwood riparian forest and drained swamp communities I (method: complete link; coefficient: Baroni-Urbani and Buser). 1/1–5 = *Fraxino pannonicae-Alnetum*, Nyírség (Kevey and Papp L. ined.); 2/1–10 = *Veratro albi-Fraxinetum angustifoliae*, Nyírség (Kevey and Papp L. ined.); 3/1–6 = *Ophioglosso-Betuletum pubescentis*, Vértesalja (Riezing and Szollát 2008–2009); 4/1–25 = *Molinio-Salicetum cinereae*, Szigetköz (Kevey 2008); 5/1–20 = *Molinio-Alnetum glutinosae*, Mezőföld (Kevey 2008); 6/1–20 = *Fraxino pannonicae-Ulmetum*, Nyírség (Kevey et al. 2017)
pubescentis) as a sister group of the Veratro albi-Fraxinetum and Fraxino pannonicae-Ulmetum cluster (Fig. 12). The dissimilarity level of the Veratro albi-Fraxinetum and Fraxino pannonicae-Ulmetum was very similar, though slightly smaller than those between the Ophioglosso-Betuletum and Molinio-Alnetum (complete linkage), and Molinio-Alnetum and Molinio-Salicetum cinereae (group average).

The result of the PCoA is in agreement with the above. In the plane of axes one and two, the samples of Veratro albi-Fraxinetum were adjacent to both, Fraxino pannonicae-Ulmetum and Ophioglosso-Betuletum pubescentis (Fig. 13). However, the position of the latter changed substantially in the plane of axes one and three, while the spatial relation of the samples of Veratro albi-Fraxinetum and Fraxino pannonicae-Ulmetum essentially did not change (Fig. 14).

Fig. 12. Binary dendrogram of alder swamp, hardwood riparian forest and drained swamp communities II (method: group average; coefficient: Baroni-Urbani and Buser). 1/1–5: Fraxino pannonicae-Alnetum, Nyírség (Kevey and Papp L. ined.); 2/1–10: Veratro albi-Fraxinetum angustifoliae, Nyírség (Kevey and Papp L. ined.); 3/1–6: Ophioglosso-Betuletum pubescentis, Vértesalja (Riezing and Szollát 2008–2009); 4/1–25: Molinio-Salicetum cinereae, Szigetköz (Kevey 2008); 5/1–20: Molinio-Alnetum glutinosae, Mezőföld (Kevey 2008); 6/1–20: Fraxino pannonicae-Ulmetum, Nyírség (Kevey et al. 2017)
FIELD OBSERVATIONS ON HABITAT CHARACTERISTICS OF VERATOM ALBI-FRAXINETUM ANGUSTIFOLIAE SUGGESTED ITS TRANSITIONAL NATURE BETWEEN FRAXINO PANNONICAE-ALNETUM AND FRAXINO PANNONICAE-ULMETUM. IT IS LIKELY THAT THIS COMMUNITY DEVELOPS FROM FRAXINO PANNONICAE-ALNETUM AS ORGANIC AND INORGANIC DEPOSITS ACCUMULATE AND THE HABITAT GRADUALLY DRIES OUT. DURING THIS PROCESS, MOST SPECIES OF THE LEMNO-POTAMEAE S. I. CLASS, AND ALSO MANY PHRAGMITETEA S. I. AND ALNETEA GLUTINOSAE S. I. SPECIES DISAPPEAR OR ARE REPLACED BY MOLINIELTALIA S. L., QUERCO-FAGETEA AND QUERCETEA PUBESCENCI-PETRAEAE SPECIES. THIS GENEALOGIC RELATIONSHIP WOULD MANIFEST ITSELF IN SIMILARITIES IN SPECIES COMPOSITION AND CHARACTER SPECIES PROPORTIONS TO BOTH ASSOCIATIONS.

IT ALSO SEEMED REASONABLE TO ASSUME THAT THIS ASSOCIATION MAY BE CLOSELY RELATED TO DRAINED SWAMP COMMUNITIES BASED ON THEIR SIMILARITIES IN HABITAT CONDITIONS. THE HABITAT OF THESE COMMUNITIES MAY BE COVERED WITH WATER IN WET PERIODS, BUT THE SOIL IS TYPICALLY NOT SATURATED WITH WATER MOST OF THE TIME. THIS ALLOWS THE ESTABLISHMENT OF MOLINIELTALIA AND QUERCETEA SPECIES IN RELATIVELY HIGH PROPORTIONS. THESE COMMUNITIES ALSO SHARE A NUMBER OF ADDITIONAL

**Fig. 13.** Ordination diagram (axes 1 and 2) of alder swamp, hardwood riparian forest and drained swamp communities I (method: principal coordinates analysis; coefficient: Baroni-Urbani and Buser). 1/1–5: Fraxino pannonicae-Alnetum, Nyírség (Kevey and Papp L. ined.); 2/1–10: Veratom albi-Fraxinetum angustifoliae, Nyírség (Kevey and Papp L. ined.); 3/1–6: Ophioglosso-Betuletum pubescentis, Vértesalja (Riezing and Szollát 2008–2009); 4/1–25: Molinio-Salicetum cinereae, Szigetköz (Kevey 2008); 5/1–20: Molinio-Alnetum glutinosae, Mezőföld (Kevey 2008); 6/1–20: Fraxino pannonicae-Ulmetum, Nyírség (Kevey et al. 2017)
features including the relatively high proportions of Phragmitetea and Alnetalia glutinosae, and the low proportion of Fagetalia elements.

Despite these similarities, the Veratro albi-Fraxinetum angustifoliae cannot be identified with any of the studied associations, but is best recognised as a novel association. Its distinctiveness is supported by a suite of evidence, including the number of differentiating species, the distribution of character species proportions, and the dissimilarity in floristical composition. In our

Fig. 14. Ordination diagram (axes 1 and 3) of alder swamp, hardwood riparian forest and drained swamp communities II (method: principal coordinates analysis; coefficient: Baroni-Urbani and Buser). 1/1–5: Fraxino pannonicae-Alnetum, Nyírség (Kevey and Papp L. ined.); 2/1–10: Veratro albi-Fraxinetum angustifoliae, Nyírség (Kevey and Papp L. ined.); 3/1–6: Ophioglosso-Betuletum pubescentis, Vértesalja (Riezing and Szollát 2008–2009); 4/1–25: Molinio-Salicetum cinereae, Szigetköz (Kevey 2008); 5/1–20: Molinio-Alnetum glutinosae, Mezőföld (Kevey 2008); 6/1–20: Fraxino pannonicae-Ulmetum, Nyírség (Kevey et al. 2017)
opinion, the amount of differences in these features are sufficiently high to designate this community as a distinct association.

Whereas the *Veratro albi-Fraxinetum angustifoliae* is best treated as a new association, its syntaxonomic affinity is rather difficult to ascertain. Owing to its intermediate characteristics in many respects, it could be placed either in the Alnetea or the Querco-Fagetea class. The Molinio-Betuletea class by Paszarge and Hofmann (1968), which includes strongly acidophilic communities distributed over the more humid western and northern parts of Europe, may be excluded for this reason. Based on preliminary data, Kevey (2008) placed the *Veratro albi-Fraxinetum angustifoliae* in the class Alnetea glutinosae, within an alliance Molinio-Alnion glutinosae, established for basiphilic drained swamp communities.

*Abbreviations: A1 = upper forest canopy layer; A2 = lower forest canopy layer; Ai = Alnion incanae; Aon = Alnion glutinosae; AQ = Aceri tatarici-Quercion; Ar = Artemisietea; Ara = Arrhenatheretalia; Arn = Arrhenatherion elatioris; Ate = Alnetea glutinosae; B1 = shrub layer; B2 = saplings; Bec = Beckmannion eruciformis; Ber = Berberidion; Bia = Bidentetalia; Bin = Bidention tripartiti; C = herbaceous layer; Cal = Calystegion sepium; Cgr = Caricion gracilis; ChS = Chenopodio-Scleranthea; Cp = Carpinetalia betuli; Des = Deschampsion caespitosae; Ep = Epilobietea angustifoliia; Epn = Epilobion angustifoliia; F = Fagetalia sylvaticae; FBt = Festuco-Brometea; FiC = Filipendulo-Cirsion oleracei; FPi = Festuco-Puccinellietalia; Fr-A = alder swamp (*Fraxino pannonicae-Alnetum*); Fr-U = hardwood riparian forest (*Fraxino pannonicae-Ulmetum*); Fvg = Festucetalia vaginatae; Fvl = Festucetalia valesiacae; GA = Galio-Alliarion; incl. = inclusive; ined. = ineditum (unpublished); M-A = drained alder swamp (*Molinio-Alnetum glutinosae*); M-S = drained willow swamp (*Molinio-Salicetum cinereae*); Mag = Magnocaricetalia; Moa = Molinietalia coerulacea; MoA = Molinio-Arrhenatheretalia; MoJ = Molinio-Juncetalia; Mon = Molinion coerulea; NC = Nardo-Callunetalia; NG = Nasturtio-Glycerietalia; O-B = drained birch swamp (*Ophioglosso-Betuletum pubescentis*); Pla = Plantaginetalia; Pna = Populenion nigro-albae; PQ = Pino-Quercetalia; Prf = Prunion fruticosae; Pru = Prunetalia spinosae; Pte = Phragmitetalia; Qc = Quercetalia cerridis; QFt = Querco-Fagetea; Qpp = Quercetalia pubescentis-petraeae; Qr = Quercetalia robori; Qrp = Quercion robori-petraeae; S = summa (sum); Sal = Salicion albae; SCn = Scheuchzerio-Caricetea nigrae; Sea = Secalietalia; s. l. = sensu lato (in the broad sense); Spu = Salicetalia purpureae; s. str. = sensu stricto (in the narrow sense); ToF = Tofieldietalia; Ulm = Ulmenion; US = Urtico-Sambucetalia, V-Fr = drained ash swamp (*Veratro albi-Fraxinetum angustifoliae*).
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