NEW OBJECTIVE METHOD FOR CALCULATING FIDELITY. EXAMPLE: THE ILLYRIAN BEECHWOODS

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Abstract - The concept of fidelity and using character species has main importance in the methodics of Zürich-Montpellier phytosociological school. In spite of their long history and importance only few of papers study this question from methodical point of view. In this paper the fidelity concept and measures are shortly rewiewed and Juhász-Nagy's unfortunately not well-known fidelity concept is reconsidered. Information statistical (G^2) functions are proposed to measure the three forms of fidelity. On the basis of this concept we suggest to distinguish faithful and character species. The application of new method is showed by an example: the Illyrian beechwoods.

Key words - Fidelity, Braun-Blanquet approach, Illyrian beechwoods

Introduction

The concept of fidelity and using character species for characterising plant communities has main importance in the methodics of Zurich-Montpellier phytosociological school (Becking, 1957). It is a distinctive feature of this approach (Barkman, 1989).

Character species may be compared with indicator species. The latter ones occur only in well-defined ecological (environmental) situation. The character species occur in determined coenological situation. Ecological and coenological situations often correspond to each other therefore character species of higher syntaxonomical units is often indicator species simultaneously. Species belonging to either of both groups are rare and have a relatively narrow distribution (Becking, 1957).

The history of idea of fidelity dates back to the last century (Lorenz, 1858 cit.; Becking, 1957). In spite of this long history and importance only few papers study this question from methodical point of view. Five degrees of fidelity proposed by Szafer and Pawlowski (1927) and slightly modified by Braun-Blanquet (1928) have been used for a long time. New method to establish degree of fidelity has been suggested by Barkman (1989). The possibilities of using statistical methods were studied by Meier Drees (1949) and Goodall (1953). Juhász-Nagy (1964) proposed a new fidelity concept with three forms of faithfulness.

Many authors deal with the geographical limitation of fidelity. Good reviews of this problem can be found in the following papers: Barkman (1989), Becking (1957), and Westhoff - van der Maarel (1980). Barkman (1989) pointed out that validity of faithfulness also limited in time.

In this paper we reconsider Juhász-Nagy's (1964) fidelity concept and propose information statistics based on binary data to measure fidelity. Usefulness of new method illustrated by the example of the Illyrian beechwoods.

FIDELITY: FOREGOING CONCEPTS AND MEASURES

Fidelity concepts

Four groups of species are used to characterise syntaxa in the Braun-Blanquet approach: dominant, constant, character (faithful) and differential species (Becking, 1957; Westhoff - van der Maarel, 1980). They form the characteristic species combination of the syntaxon. The character and differential species differ from the groups of dominant and constant species. These species do not occur in all relevés which are classed into the framework of a given syntaxon as the constant species and generally are not represented with a high cover degree as dominant species do (Becking, 1957). They prefer a given syntaxa rather than all of other syntaxa in the studied situation (character species) or at least one of other syntaxa (differential species) (Westhoff - van der Maarel, 1980).

Juhász-Nagy's paper (1964) unfortunately not well-known and not considered according its merit, is an important milestone in the process of development of fidelity concepts. He regarded "vegetation as the integrated phytometer (-indicator) system". "Concerning fidelity, it means that not only some distinguished 'Kennarten' and 'Trennarten' are important but all (!) populations are 'characteristic' in their own way (i.e. according their grades of fidelity)." Consequently, numerical (probabilistic) approach of fidelity is very important. He suggests to test fidelity by Chi^2-test.

Juhász-Nagy (1964) and independently of his work, also Barkman (1989) pointed out that the faithfulness may be negative. If the species does not prefer the given syntaxon it may mean two different facts:

- the species does not have coenological preference,
- it prefers relevés that do not fall under given syntaxon.

In the first case the faithfulness of species is zero. In the second case it is negative.

In addition Juhász-Nagy (1964) discovered and distinguished three forms of fidelity and the traditional idea of fidelity is only one of them. From mathematical point of view relationship between species and syntaxon seems to be symmetric. He wrote: "an important but neglected point is the dual character of fidelity concept. Namely fidelity of the species to the syntaxon and vice versa fidelity of the syntaxon to the species. [...] Even, more clearly, from the degree of coincidence of these fidelity types a third kind of faithfulness is distinguishable. [...] Moreover, a distinction can be made between 'positive' and 'negative' fidelity."

The traditional fidelity (positive fidelity of species to the syntaxon) means that the species occurs only in the given syntaxon. In the case of negative fidelity of species to the syntaxon it means that the species does not occur in the given syntaxon. The fidelity of the syntaxon to the species means that if the species does not occur in one relevé it probably does not belong to the given syntaxon. Of course, negative faithfulness of syntaxon to species is also possible. If the faithfulness of species is considered, it can be established that syntaxonomical status of a relevé depends on occurrence of species. On the other hand in case of faithfulness of syntaxon occurrence of species depend on syntaxonomical status of a relevé. In the case of the third form of fidelity, which may be called joint fidelity, syntaxonomical status of the relevé and occurrence of the species is not independent from each other.

Now, let us consider them by some simple examples. In fig. 1.a. the species is faithful to the syntaxon, but it is not true reciprocally (e.g. endemic species, "true" character species), whereas in the fig. 1.b. the syntaxon is very faithful to the species (the species occurs in most of relevés falling under the syntaxon), but the species is not faithful to the syntaxon. In both cases the coincidence of the two kinds of fidelities is small, therefore the third fidelity form, namely joint fidelity is low. In fig. 1.c. the species occurs only in the syntaxon (the species is faithful to it) and the species occurs in all relevés belonging to the syntaxon (the syntaxon is faithful to the species) therefore the [illegible] fig. 1.d.,

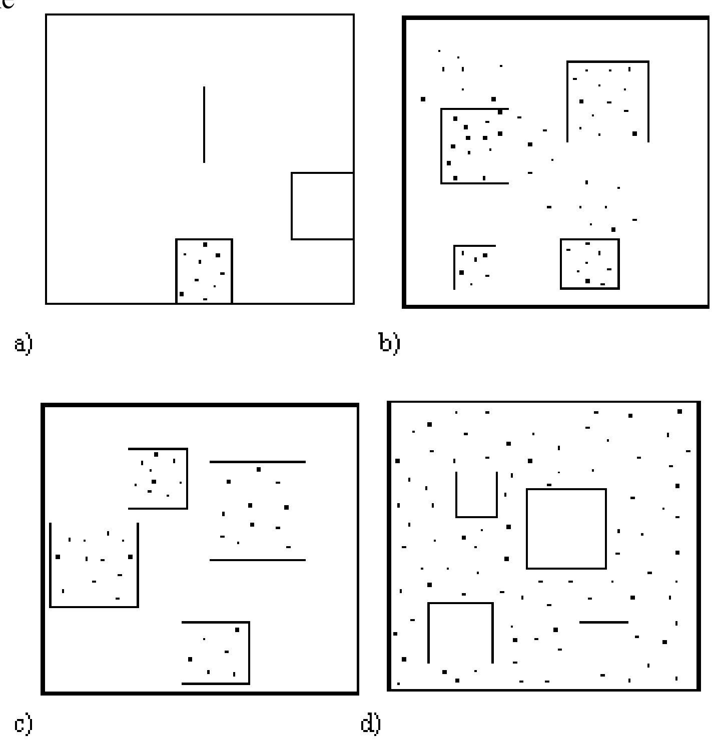

Fig. 1 - Some extreme examples of different types of fidelity. a. the species is faithful to the syntaxon (but it is not true vice versa); b. the syntaxon is faithful to the species; c. positive joint fidelity; d. negative joint fidelity. (Legends: square=syntaxon, point=occurence of species).

namely the high negative joint fidelity.

In the foregoing relationships between species and syntaxa are shown. Barkman (1989) suggested that not only species may be faithful to syntaxa. Use of other taxonomical levels or non-taxonomical groups of species (ECUs = elementary coenological units) is also possible. Landolt (1977) showed examples when eco- or caryotypes have different coenological preferences. They may have importance in phytosociological research only if they can be identified in field. In this paper we use species instead of ECUs because the species category is the most frequently used of them but our statements are valid for others.

French authors (Brisse *et al.* 1995; Brisse, De Ruffray, Grandjouan, 1996; Brisse, Grandjouan, De Ruffray, 1996) use fidelity term with new meaning. Their concept is very interesting in the use of phytosociological databases but differs from the classical fidelity concept, therefore it is not discussed here.

Fidelity measures

The most wide-spread fidelity scale was proposed by Szafer and Pawlowsky (1927). Later it was modified by Braun-Blanquet (1928). It is based on comparing constancy, cover and vitality of species (Becking, 1957; Westhoff - van der Maarel, 1980). The weak-point of this method is not being defined exactly the "comparable phytocoena". There are two possibilities: the most similar syntaxon or "average" of all syntaxa belonging to a higher one or the same occurring in the study area (Barkman, 1989). We prefer to use the second possibility.

Becking (1961 cit.; Barkman, 1989) consider a species faithful to a syntaxon if its constancy, cover and vitality in the stands of the syntaxon are higher then in the average of study area. Meier Drees (1949) and Goodall (1953) suggested using statistical methods, t-test and Chi^2-test respectively, to establish faithful species. Barkman (1989) proposed new fidelity scale with five degrees based on average transformed A-D value.

THE NEW METHOD

Fidelity

Let us introduce some marks into the discussion of new method. Let *j* be the studied species and **A** the studied syntaxon. **A** is a set of relevés. It is a subset of all relevés which we used in the analysis. Any syntaxon may be defined as a set of relevés and from mathematical point of view any set of relevés may be regarded as a syntaxon. Let $\bar{\mathbf{A}}$ be the set of relevés which are not classed among **A**. Based on earlier definition it may be considered as a syntaxon. Therefore, faithfulness of species to $\bar{\mathbf{A}}$ or faithfulness of $\bar{\mathbf{A}}$ to the species also can be analysed. Let us classify relevés to study fidelity in two ways:

- the relevé falls under **A** or not
- *j* occurs in the relevé or not

	j		
	1	0	Σ
A	a	b	a + b
$\bar{A}$	c	d	c + d
Σ	a + c	b + d	N

and let us make the following cross-classification table:

We could see in the section 2.2. that if *j* is faithful to **A** then syntaxonomical status of relevés depends on occurrence of *j*. It can be tested by G-test. The null hypothesis

$$F_1 = \begin{bmatrix} a \\ c \end{bmatrix} \quad \text{and} \quad F_2 = \begin{bmatrix} b \\ d \end{bmatrix}$$

of test is the following: the two frequency distributions

$$P_1 = \begin{bmatrix} a/(a+c) \\ c/(a+c) \end{bmatrix} \quad \text{and} \quad P_2 = \begin{bmatrix} b/(b+d) \\ d/(b+d) \end{bmatrix}$$

and the corresponding relative frequency distributions do not differ significantly. If this hypothesis would be false *j* is faithful to **A** or $\bar{A}$. If *j* is positively faithful to **A** it occurs more frequently in **A** than $\bar{A}$. If *j* is positively faithful to $\bar{A}$ its fidelity to **A** is negative. The sign of fidelity is positive if P_{11} is more than P_{21} and otherwise it is negative. The used statistics can be calculated by the following:

$$2I(F_1, F_2) = 2\sum_i \sum_j F_{ij} \ln \frac{P_{ij}}{P_j}$$

where:

$$P_j = \frac{P_{1j} + P_{2j}}{2}$$

or in other form:

$$2I(F_1, F_2) = 2 \cdot \left[a \cdot \ln \frac{2P_{11}}{P_{11} + P_{21}} + b \cdot \ln \frac{2P_{21}}{P_{11} + P_{21}} + c \cdot \ln \frac{2P_{12}}{P_{12} + P_{22}} + d \cdot \ln \frac{2P_{22}}{P_{12} + P_{22}} \right]$$

It is suggested that $2I(F_1,F_2)$ should be regarded as the absolute value of faithfulness. If the null-hypothesis is true the distribution of function is Chi^2 distribution with 1 degree of freedom. If the calculated function is high than the critical value of Chi^2 table the null-hypothesis is probably false that is to say *j* is faithful to **A**.

The faithfulness of **A** to *j* can be analysed similarly because columns and rows of cross-classification table can be inverted. In this case the compared frequency distributions are

$$G_1 = \begin{bmatrix} a \\ b \end{bmatrix} \quad \text{and} \quad G_2 = \begin{bmatrix} c \\ d \end{bmatrix}$$

and the corresponding relative frequency distributions are

$$Q_1 = \begin{bmatrix} a/(a+b) \\ b/(a+b) \end{bmatrix} \quad \text{and} \quad Q_2 = \begin{bmatrix} c/(c+d) \\ d/(c+d) \end{bmatrix}$$

The calculated statistics is:

$$2I(G_1, G_2) = 2\sum_i \sum_j G_{ij} \ln \frac{Q_{ij}}{Q_j}$$

where:

$$Q_j = \frac{Q_{1j} + Q_{2j}}{2}$$

or in other form:

$$2I(G_1, G_2) = 2 \cdot \left[a \cdot \ln \frac{2Q_{11}}{Q_{11} + Q_{21}} + b \cdot \ln \frac{2Q_{12}}{Q_{12} + Q_{22}} + c \cdot \ln \frac{2Q_{21}}{Q_{11} + Q_{21}} + d \cdot \ln \frac{2Q_{22}}{Q_{12} + Q_{22}} \right]$$

It also has Chi^2 distribution with 1 degree of freedom if the two frequency distributions do not differ significantly. The sign of faithfulness is positive if Q_{11} is higher than Q_{21} and it is negative otherwise.

If **A** and *j* are mutually faithful, their occurrences depend on each other. In other words the observed

$$H = \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix} \quad \text{and the expected} \quad H^0 = \begin{bmatrix} (a+c)(a+b)/N \\ (b+d)(a+b)/N \\ (a+c)(c+d)/N \\ (b+d)(c+d)/N \end{bmatrix}$$

frequency distributions differ significantly[1] . It also can be tested by G-test:

$$2I(H;H^0) = 2\sum_j H_j \ln \frac{H_j}{H_j^0}$$

The calculated function has Chi^2 distribution with 1 degree of freedom if the two frequency distributions do not differ significantly. If the calculated value is higher than the critical value of Chi^2 table the **A** and *j* are mutually faithful. The sign of faithfulness is positive if ad-bc>0 and negative otherwise.

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[1] We would like to note that in all of three cases observed and expected frequency distributions are compared by G-test. Expected frequencies are calculated by different way and only this is the usual way in statistics (e.g. Sokal - Rohlf, 1981).

Character species   Character and faithful species are used as the synonyms in the literature. We suggest here that character species are subset of faithful species. We can deduce syntaxonomical status of the given relevé from occurrence or missing of faithful species. If the probability of wrong conclusion is less than the determined critical value (e.g. 5%) the species is character species.

In the previous section different types of fidelity have been established. Regarding to this fact different types of character species should be defined.

Type I.a. If *j* and **A** are mutually faithful then on one hand relevés in which *j* occurs generally are classed among **A** and on the other one *j* generally occurs in the relevés which fall under **A**. Consequently, if j occurs in any relevé we can conclude that it falls under **A**. In other case we have to qualify it not being classed among **A** (it is classed among). The probability of errors is E_1=c/(a+c) in the first case and E_2=d/ is, if the mutual faithfulness is negative. It means that and *j* are mut(b+d) in the second case.

Type I.b. Exactly the opposite of the previous case is, if the mutual faithfulness is negative. It means that and *j* are mutually faithful. Thus, if *j* occurs in any relevé it means that the relevé does not fall under **A** (falls under) and if *j* does not occur in any relevé we can conclude that it is to be classed among **A** (does not fall under A). The probability of wrong decision is 1-E_1 in the first case and 1-E_2 in the second case.

Type II.a. If *j* is faithful to **A** it means that in most of cases *j* occurs in relevés classed among **A**. Therefore, if *j* occurs in any relevé then the relevé is classed among **A**, but we cannot get any conclusion from missing of *j*. The probability of wrong conclusion is E_1.

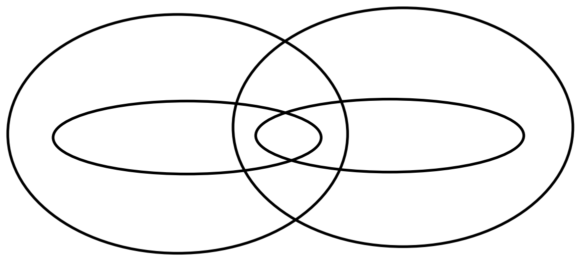
Type II.b. If *j* is negatively faithful to **A** it means that *j* is faithful to A. Therefore, its occurrence in any relevé means that relevé does not falling under **A** (falls under). The probability of misclassification is 1-E_1.

Type III.a. If **A** is faithful to *j* it occurs in most of relevés belonging to **A**. Thus if *j* does not occur in any relevé it can be supposed not falling under **A**. The probability of error is E_2. In this case any conclusion cannot be taken from the occurrence of j.

Type III.b. If **A** is negatively faithful to *j*, in other words A is faithful to *j*, it means that *j* occurs in most of relevés not classed among **A**. Therefore, if *j* does not occur in any relevé we can conclude this relevé does not falling under A so it falls under **A**.

It is to be emphasised that certain hierarchy exists among faithful and character species. It is illustrated by Venn-diagram in figure 2. When the results are interpreted each species should be classified in an only, the narrowest category. For example I.a. type character species should not be listed as II.a. and III.a. type character species.

Fig. 2 - Illustration of hierarchy of faithful and character species by Venn-diagram Legends: 1. the species is faithful to the syntaxon; 2. the syntaxon is faithful to the species; 3. the species and the syntaxon are faithful to each other; 4. character species type II.; 5. character species type III.; 6. character species type I..



Limitations of results

It is well-known that validity of fidelity is limited in geographical (real) space. We suggest here that it is also restricted in syntaxonomical (classification) space (about different spaces see Podani, 1984).

Let us consider this question from statistical point of view. In the analysis we estimate fidelity value based on a sample consisting of a limited number of relevés, because all of the possible relevés cannot be analysed. The results are valid to this sample and the population (in statistical meaning) which is represented by the sample. The population can be defined in geographical space (for example vegetation of the Carpathian basin independently of syntaxonomical status), in syntaxonomical space (for example Illyrian beechwoods independently of their location) and in both spaces (for example beechwoods of the Carpathian basin).

Of course, the faithful and character species of any syntaxon may differ in different populations. Therefore, the results must not be interpreted without their limitation.

By subjective methods general phytosociological behaviour of species can be described and general faithful species can be established. In practise its validity is also particular because behaviour of species may be different in different regions and the knowledge of researcher is limited for some regions. Our objective method calculates fidelity from sample and establishes faithful species with restricted validity. The advantage of this method is the well-defined validity of results.

AN EXAMPLE: THE ILLYRIAN BEECHWOODS

Materials

771 phytosociological samples compiled by Borhidi (1963) were submitted to the analysis. Numeric syntaxonomical revision of this data set was carried out by Török *et al*. (1989), where the following suballiances were confirmed:

Primulo vulgaris – Fagenion Borhidi 1963 for the oak-hornbeamwoods and submontane beechwoods

Lamio orvalae – Fagenion Borhidi in Török *et al*. 1989 for the montane beechwoods

Lonicero – Fagenion Borhidi 1963 for the high montane beechwoods and spruce-beech mixed forests

Ostryo – Fagenion Borhidi 1963 for the thermophilous and rocky beechwoods

In this work faithful and character species of these suballiances are studied within the framework of the alliance. Therefore, they are valid only if the studied relevés fall under the *Aremonio-Fagion* Borhidi in Török *et al*. 1989 alliance.

Results

344 of the 644 species have some significant fidelity value. Constancy values and fidelity properties of these species are shown in table 1. Average values of constancy within the different fidelity types was summarised in table 2. It can be stated that if a species is faithful to one syntaxon its constancy will be low in all other three syntaxa. On the other hand when a syntaxon is faithful to one species, the constancy of this species will be significantly lower, but not necessarily low in the other three syntaxa. If lower syntaxonomical units (e.g. associations, subassociations) were compared, the difference between the two cases explained before would be more obvious, because there number of species with high constancy would be higher.

The *Primulo vulgaris–Fagenion* suballiance has many character species of both type II.a. and type II.b. This suballiance contains a composition of species represented in both the oak-hornbeam woods and the collin-submontane beechwoods both rich in species of the lower forest belts. In comparison with the species-pool of the other suballiances distributed in the higher altitudes, not only the real – rather few and not very frequent – character species (e.g. *Knautia drymeia, Lathyrus venetus*, *Festuca drymeia*) turn to be characteristic to this unit, but also a large number of species, common in the oak forest belt (e.g. *Dactylis polygama, Geum urbanum, Poa nemoralis*), but not reaching to the montane belt considered traditionally as differential species. Some species are common with submontane beechwoods but absent or very rare in high montane and rocky forests (e.g. *Hedera helix, Tamus communis, Scrophularia nodosa, Carex pilosa*).

The negative characteristic species (type II.b.) consequently occur in the montane and high montane belts, rocky places, etc. and not only in the beechwoods, but with high frequency in them. Their occurrence is negatively characteristic to the *Primulo-Fagenion* suballiance. Some of them are negative characteristic species of *Lamio orvalae-Fagenion*, too. These species occur only in the high mountain region (e.g. *Adenostyles alliariae, Ranunculus platanifolius, Lonicera nigra*) or common species of the high montane and rocky beechwoods (e.g. *Iris graminea, Rhamnus fallax, Rubus saxatilis*).

The suballiance of the montane beechwoods (*Lamio orvalae–Fagenion*) is occupying a central place in the altitudinal range of the beechwoods, consequently it may have species both from the higher and from the lower belt. Therefore it has a less number of positive character species (type II a; *Ilex aquifolium, Melampyrum velebiticum, Moehringia muscosa, Ramischia secunda*) and a much larger number of negative character species (type II b). The latter group is very heterogeneous. It may contain characteristic species both of the collin-submontane (see above) and high montane regions (see below). There are many species which mutually faithful to this suballiance. They may be species common with the collin-submontane (e.g. *Athyrium filix-femina, Acer platanoides, Polygonatum multiflorum, Salvia glutinosa*) or high montane belts (e.g. *Hacquetia epipactis, Prenanthes purpurea, Lonicera. xylosteum*).

The suballiance of the beechwoods of the higher altitudes (*Lonicero–Fagenion*) has a larger number of positive character species (in addition to species mentioned above *Acer visianii, Valeriana montana, Astrantia major* subsp. *illyrica, Pancicia serbica, Polygonatum verticillatum, Ribes alpinum*) and an extremely high number of character species, principally those of lower altitudes.

The thermophilous and rocky beechwoods (*Ostryo–Fagenion*) have a number of heliophilous plants whose constancy significantly less in other beechwoods, therefore these are character species type III. a. of this suballiance. Since the habitats of this suballiance may occur in all altitudes (submontane, montane and high montane region), these species may be also faithful to *Primulo vulgaris – Fagenion* (e.g. *Acer campestre, Fraxinus ornus, Lathyrus vernus*), to *Lamio orvalae–Fagenion (Sorbus aria, Laserpitium marginatum*) or to *Lonicero–Fagenion* (*Luzula sylvatica, Vaccinium myrtillus, Rubus saxatilis, Rhamnus fallax*). Many of these species are common with the thermophilous oak woods and shrubwoods (e.g. *Acer campestre, Cotonoaster tomentosa, Sorbus aria, Viburnum lanata*). This suballiance is negatively faithful to species which are common in some other types of beechwoods but rarely occur in the thermophilous or rocky habitats (e.g. *Asperula odorata, Dentaria bulbifera, Dryopteris filix-mas, Rubus hirtus, Paris quadrifolia*). There is only one species, the *Spiraea media*, which can be regarded as a character species of type I.a. for this suballiance, because it occurs only in this syntaxon (i.e. the species faithful to it) and its constancy is high (i.e. the syntaxon is faithful to the species).

Hopefully, these examples show the usefulness of the new method to analysis of fidelity. The aim is to illustrate its application Further information can be obtained by a more detailed examination of table 1.

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TABLE 1 - Constancy and fidelity of species. Abbreviations: 1. Primulo vulgaris – Fagenion, 2. Lamio orvalae – Fagenion, 3. Lonicero – Fagenion, 4. Ostryo – Fagenion, I.a., II.a., II.b., III.a.= different type character species, J+ significant positive mutual fidelity, J- significant negative mutual fidelity, S+ the syntaxon is faithful to the species, S- the syntaxon is negatively faithful to the species, T+ the species is faithful to the syntaxon, T- the species is faithful to the syntaxon.

	Constancy (%)				Fidelity			
Species	1	2	3	4	1	2	3	4
Abies alba	0,00	27,50	36,08	0,00	II.b., J-	J+	J+	S-
Acer campestre	45,21	33,75	0,00	60,00	J+		II.b., J-	III.a.
Acer hyrcanum	0,61	0,00	0,00	0,00	II.a.	II.b.	II.b.	
Acer obtusatum	1,22	0,00	4,12	26,67	T-	II.b.	T+	III.a., J+
Acer platanoides	18,53	29,38	4,12	40,00		J+	II.b., J-	III.a.
Acer pseudoplatanus	19,96	68,75	46,39	73,33	J-	J+	S+	III.a.
Acer tataricum	12,83	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Acer visianii	0,00	0,00	9,28	0,00	II.b., J-	II.b.	II.a., J+	
Aconitum vulparia	11,20	18,75	4,12	0,00		J+	II.b., J-	S-
Actaea spicata	9,37	53,13	18,56	0,00	J-	J+		S-
Adenostyles alliariae	0,00	0,00	12,37	0,00	II.b., J-	II.b.	II.a., J+	
Adoxa moschatellina	6,52	5,63	28,87	0,00	J-		J+	S-
Aegopodium podagraria	24,24	10,00	0,00	0,00	J+	J-	II.b., J-	S-
Ajuga genevensis	2,85	0,00	0,00	0,00	II.a., J+	II.b.	II.b.	
Ajuga reptans	41,34	18,13	9,28	0,00	J+	J-	II.b., J-	J-
Alliaria petiolata	10,59	2,50	2,06	0,00	J+	J-	II.b., J-	S-
Allium ursinum	20,98	0,63	5,15	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Alnus glutinosa	2,85	0,00	0,00	0,00	II.a., J+	II.b.	II.b.	
Anemone nemorosa	35,44	76,88	91,75	93,33	J-	J+	J+	III.a., J+
Anemone ranunculoides	23,22	5,63	16,49	0,00	J+	J-		S-
Anemone trifolia	0,41	11,25	4,12	0,00	J-	J+		
Aposeris foetida	11,61	48,75	11,34	0,00	J-	J+	S-	S-
Aquilegia vulgaris	0,20	2,50	0,00	0,00	T-	J+	II.b.	
Arabis hirsuta	0,41	0,63	0,00	0,00		T+	II.b.	
Arabis turrita	4,89	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	
Aremonia agrimonoides	23,01	24,38	52,58	80,00	J-		J+	III.a., J+
Arum maculatum intermedium	29,53	21,25	27,84	0,00				J-
Aruncus vulgaris	1,02	16,25	8,25	0,00	J-	J+		S-
Asarum europaeum	59,06	36,88	15,46	86,67	J+	J-	II.b., J-	III.a.
Asparagus tenuifolius	1,22	0,00	0,00	0,00	II.a.	II.b.	II.b.	
Asperula odorata	68,64	71,88	84,54	0,00			J+	J-
Asperula taurina	8,55	0,00	2,06	0,00	II.a., J+	II.b., J-	T-	S-
Asplenium adiantum-nigrum	2,24	0,00	0,00	0,00	II.a.	II.b.	II.b.	
Asplenium trichomanes	5,91	3,13	0,00	0,00	T+		II.b., J-	S-
Astragalus glycyplyllos	6,72	6,88	0,00	0,00	T+		II.b., J-	S-
Astrantia elatior	1,22	0,00	11,34	6,67	T-	II.b., J-	J+	
Astrantia major subsp. illyrica	0,00	0,00	2,06	0,00	II.b.	II.b.	II.a., J+	
Athyrium filix-femina	21,38	40,00	17,53	0,00		J+		J-
Atropa bella-donna	1,83	0,00	0,00	0,00	II.a.	II.b.	II.b.	
Berberis vulgaris	2,04	8,75	0,00	0,00	T-	J+	II.b., J-	
Betula pendula	1,83	4,38	4,12	66,67	J-			III.a., J+
Brachypodium pinnatum	1,02	1,25	0,00	0,00			II.b.	

	Constancy (%)				Fidelity			
Species	1	2	3	4	1	2	3	4
Brachypodium sylvaticum	22,00	10,00	4,12	53,33	J+	J-	II.b., J-	III.a., J+
Bromus benekeni	8,15	2,50	0,00	0,00	J+	T-	II.b., J-	S-
Calamagrostis varia	0,00	6,88	2,06	60,00	II.b., J-	J+		III.a., J+
Calamintha grandiflora	0,41	11,88	25,77	0,00	II.b., J-	J+	J+	S-
Campanula patula	1,83	0,00	0,00	0,00	II.a.	II.b.	II.b.	
Campanula persicifolia	6,72	6,25	0,00	6,67	T+		II.b., J-	
Campanula ranunculoides	4,07	0,00	9,28	0,00		II.b., J-	J+	S-
Campanula sphaerothrix	1,63	0,00	0,00	0,00	II.a.	II.b.	II.b.	
Campanula trachelium	19,14	11,88	7,22	0,00	J+		J-	S-
Caphalantera longifolia	10,39	22,50	8,25	13,33				
Cardamine impatiens	7,33	0,63	5,15	0,00	J+	II.b., J-		S-
Cardamine trifolia	0,61	9,38	10,31	0,00	J-	J+		S-
Carex brizoides	4,89	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	
Carex digitata	22,20	41,25	4,12	0,00		J+	II.b., J-	J-
Carex divulsa	3,46	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b.	
Carex flacca	3,87	11,25	0,00	0,00	T-	J+	II.b., J-	S-
Carex pairei	2,24	0,00	0,00	0,00	II.a.	II.b.	II.b.	
Carex pendula	6,52	8,75	0,00	0,00		T+	II.b., J-	S-
Carex pilosa	41,96	23,13	3,09	0,00	J+	S-	II.b., J-	J-
Carex remota	4,68	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	
Carex sylvatica	38,49	53,13	20,62	0,00		J+	J-	J-
Carpinus betulus	76,99	18,75	3,09	6,67	J+	J-	II.b., J-	J-
Carpinus orientalis	2,65	0,00	0,00	6,67	T+	II.b.	II.b.	III.a., J+
Castanea sativa	6,72	8,75	0,00	0,00			II.b., J-	S-
Cephalanhtera rubra	2,04	13,13	2,06	0,00	J-	J+		S-
Cephalanthera damasonium	0,81	13,13	0,00	0,00	J-	J+	II.b., J-	
Cerasus avium	36,05	35,63	4,12	60,00			II.b., J-	III.a.
Chaerophyllum temulum	3,05	0,00	0,00	0,00	II.a., J+	II.b.	II.b.	
Chelidonium majus	4,48	3,75	0,00	0,00	T+		II.b., J-	S-
Chrysanthemum corymbosum	4,28	3,13	0,00	0,00	T+		II.b., J-	S-
Chrysoplenium alternifolium	8,15	1,88	6,19	0,00	T+	J-		S-
Circaea lutetiana	15,48	8,75	9,28	0,00	T+			S-
Cirsium erisithales	0,00	2,50	15,46	26,67	II.b., J-		J+	III.a., J+
Clematis vitalba	12,22	23,75	0,00	0,00		J+	II.b., J-	S-
Convallaria majalis	17,72	11,25	7,22	60,00			J-	III.a., J+
Cornus mas	16,09	3,13	0,00	6,67	J+	J-	II.b., J-	
Cornus sanguinea	31,36	23,13	0,00	0,00	J+		II.b., J-	J-
Coronilla varia	0,20	0,00	0,00	26,67	T-	II.b.	II.b.	III.a., J+
Corydalis cava	13,03	8,13	39,18	0,00		J-	J+	S-
Corydalis solida	9,98	4,38	0,00	0,00	J+	T-	II.b., J-	S-
Corylus avellana	29,33	33,75	2,06	60,00			II.b., J-	III.a.
Corylus colurna	1,02	0,00	0,00	40,00	T-	II.b.	II.b.	III.a., J+
Cotonoaster tomentosa	0,20	0,00	3,09	53,33	J-	II.b.	T+	III.a., J+
Cotinus coggygria	0,20	0,00	1,03	26,67	T-	II.b.		III.a., J+
Crategus monogyna	41,96	30,63	0,00	0,00	J+		II.b., J-	J-
Crategus oxyacantha	15,07	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Crocus neapolitanus	8,76	8,13	0,00	0,00	T+		II.b., J-	S-
Cruciata laevipes	2,65	0,00	0,00	0,00	II.a., J+	II.b.	II.b.	
Cyclamen purpurascens	12,22	69,38	9,28	0,00	J-	J+	II.b., J-	J-

Constancy (%) Fidelity

Species	1	2	3	4	1	2	3	4
Cynanchum vincetoxicum	2,65	0,00	0,00	40,00		II.b., J-	II.b., J-	III.a., J+
Cystopteris fragilis	5,30	1,25	0,00	0,00	J+	T-	II.b., J-	S-
Cytisus hirsutus	2,04	0,00	3,09	0,00	T+	II.b.	T+	
Cytisus supinus	2,44	1,88	0,00	0,00			II.b.	
Dactylis polygama	30,75	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Danaa cornubiensis	3,87	0,00	0,00	66,67		II.b., J-	II.b., J-	III.a., J+
Daphne laureola	3,05	13,13	0,00	0,00	T-	J+	II.b., J-	S-
Daphne mezereum	20,37	76,25	24,74	33,33	J-	J+		
Dentaria bulbifera	44,60	85,63	78,35	13,33	J-	J+	J+	J-
Dentaria enneaphyllos	9,98	58,75	75,26	0,00	J-	J+	J+	J-
Dentaria pentaphyllos	0,20	0,63	0,00	0,00	T-	T+	II.b.	
Dentaria polyphylla	0,20	15,00	41,24	0,00	II.b., J-	J+	J+	S-
Dentaria trifolia	0,00	19,38	22,68	0,00	II.b., J-	J+	J+	S-
Deschampsia caespitosa	2,44	0,00	0,00	0,00	II.a., J+	II.b.	II.b.	
Dianthus barbatus	2,85	0,00	0,00	0,00	II.a., J+	II.b.	II.b.	
Digitalis grandiflora	1,63	2,50	0,00	0,00		T+	II.b.	
Digitalis lanata	1,63	0,00	4,12	46,67	T-	II.b., J-	T+	III.a., J+
Doronicum austriacum	2,85	6,25	5,15	0,00	T-	T+		S-
Doronicum columnae	1,43	0,00	1,03	20,00		II.b.		III.a., J+
Doronicum orientale	1,83	0,00	0,00	0,00	II.a.	II.b.	II.b.	
Dryopteris carthusiana	4,48	0,00	0,00	0,00	II.a.	II.b., J-	II.b., J-	
Dryopteris dilatata	0,20	0,00	13,40	0,00	J-	II.b.	J+	
Dryopteris filix-mas	45,01	64,38	63,92	6,67	J-	J+	S+	J-
Epilobium montanum	9,78	6,88	16,49	0,00			J+	S-
Epimedium alpinum	7,74	36,88	10,31	0,00	J-	J+		S-
Epipactis helleborine	7,54	12,50	6,19	0,00		T+		S-
Equisetum telmateia	4,07	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	
Erythronium dens-canis	7,13	5,00	9,28	40,00				III.a., J+
Euonymus europaeus	17,31	6,25	0,00	0,00	J+	J-	II.b., J-	S-
Euonymus latifolia	0,41	30,00	5,15	0,00	II.b., J-	J+		S-
Euonymus verrucosus	10,39	8,13	2,06	66,67			II.b., J-	III.a., J+
Euphorbia amygdaloides	51,12	45,00	42,27	60,00				
Euphorbia dulcis	18,13	27,50	4,12	0,00		J+	II.b., J-	S-
Euphorbia polychroma	0,81	0,00	0,00	0,00	II.a.	II.b.	II.b.	
Fagus sylvatica	52,34	98,13	90,72	66,67	J-	J+	J+	
Fagus sylvatica subsp. moesica	74,34	16,88	62,89	66,67	J+	J-		
Festuca drymeia	15,89	1,25	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Festuca gigantea	3,87	1,25	0,00	0,00	T+	T-	II.b., J-	
Festuca heterophylla	12,02	0,00	11,34	13,33	J+	II.b., J-		
Festuca sylvatica	0,20	2,50	10,31	0,00	J-		J+	
Ficaria verna	22,81	1,88	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Fragaria moschata	5,09	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	
Frangula alnus	7,13	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Fraxinus angustifolia	4,48	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	
Fraxinus excelsior	9,98	4,38	8,25	6,67	T+	T-		
Fraxinus ornus	38,29	20,63	1,03	100,00	J+	J-	II.b., J-	III.a., J+
Gagea lutea	4,68	1,25	4,12	0,00	T+	T-		S-
Galanthus nivalis	17,31	11,88	22,68	0,00				S-
Galeopsis pubescens	5,09	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	
		Constancy (%)				Fidelity		
Species	1	2	3	4	1	2	3	4

Galeopsis speciosa	2,04	0,63	0,00	0,00	T+	T-	II.b.	
Galium aparine	7,13	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Galium aristatum	5,09	2,50	0,00	0,00	T+		II.b., J-	S-
Galium mollugo s.l.	3,87	0,63	0,00	40,00		T-	II.b., J-	III.a., J+
Galium rotundifolium	0,20	0,00	15,46	0,00	J-	II.b., J-	J+	
Galium schultesii	8,96	1,25	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Galium sylvaticum	19,35	33,75	8,25	53,33		J+	II.b., J-	III.a., J+
Galium vernum	19,96	8,13	0,00	0,00	J+	J-	II.b., J-	S-
Genista ovata subsp. nervata	3,87	0,00	1,03	6,67	T+	II.b., J-	II.b.	
Genista tinctoria	2,24	0,63	0,00	0,00	T+	T-	II.b.	
Gentiana asclepiadea	5,30	35,00	4,12	33,33	J-	J+	II.b.	III.a., J+
Geranium macrorrhizum	1,43	0,00	2,06	53,33	T-	II.b., J-		III.a., J+
Geranium phaeum	15,68	3,13	4,12	0,00	J+	J-	II.b., J-	S-
Geranium robertianum	24,44	4,38	14,43	0,00	J+	II.b., J-		S-
Geum urbanum	30,75	0,00	2,06	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Glechoma hirsuta	27,70	7,50	5,15	0,00	J+	J-	II.b., J-	S-
Hacquetia epipactis	3,87	33,13	19,59	0,00	J-	J+	J+	S-
Hedera helix	56,21	60,63	0,00	20,00	J+	S+	II.b., J-	S-
Helleborus atrorubens	3,87	3,75	0,00	0,00	T+		II.b., J-	
Helleborus dumetorum	5,30	0,63	3,09	0,00	T+	II.b., J-		S-
Helleborus niger subsp. macranthus	0,00	23,13	2,06	0,00	II.b., J-	J+	T-	S-
Helleborus odorus	26,88	0,63	4,12	13,33	II.a., J+	II.b., J-	II.b., J-	
Hepatica nobilis	28,31	20,63	14,43	60,00			J-	III.a.
Heracleum sphodylium	22,00	20,00	4,12	0,00	T+		II.b., J-	S-
Hieracium racemosum	7,33	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Hieracium sabaudum	6,31	1,88	0,00	0,00	J+	T-	II.b., J-	S-
Hieracium silvaticum	14,05	13,75	6,19	0,00			J-	S-
Hieracium umbellatum	2,65	0,00	0,00	0,00	II.a., J+	II.b.	II.b.	
Homogyne sylvestris	0,00	6,25	9,28	0,00	II.b., J-	J+	J+	
Hordelymus europaeus	0,81	0,00	12,37	0,00	J-	II.b., J-	J+	
Hypericum hirsutum	7,33	2,50	0,00	0,00	J+	T-	II.b., J-	S-
Hypericum montanum	3,46	0,63	0,00	0,00	T+	T-	II.b.	
Hypericum perforatum	7,94	5,00	0,00	0,00	T+		II.b., J-	S-
Ilex aquifolium	0,00	8,75	0,00	0,00	II.b., J-	II.a., J+	II.b.	
Impatiens noli-tangere	2,24	0,00	2,06	0,00	T+	II.b.		
Iris graminea	0,00	0,00	3,09	13,33	II.b., J-	II.b.	J+	III.a., J+
Isopyrum thalictroides	9,37	10,63	21,65	0,00			J+	S-
Juniperus communis	2,65	1,25	0,00	0,00	T+		II.b.	
Knautia drymeia	28,51	3,13	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Lamium galeobdolon	46,64	55,00	38,14	40,00				
Lamium maculatum	10,59	0,00	6,19	0,00	J+	II.b., J-		S-
Lamium orvala	9,16	40,63	7,22	0,00	J-	J+	J-	S-
Lapsana communis	6,52	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Laserpitium marginatum	0,00	15,63	6,19	73,33	II.b., J-	J+		III.a., J+
Lathraea squamaria	7,13	0,63	1,03	0,00	J+	II.b., J-	II.b., J-	S-
Lathyrus montanus	3,05	1,25	0,00	0,00	T+	T-	II.b., J-	
Lathyrus niger	6,72	1,88	0,00	20,00	T+	T-	II.b., J-	III.a., J+
Lathyrus ochraceus	0,41	0,00	4,12	0,00	T-	II.b.	J+	
Lathyrus venetus	39,71	0,00	2,06	0,00	II.a., J+	II.b., J-	II.b., J-	J-
	Constancy (%)				Fidelity			
Species	1	2	3	4	1	2	3	4
Lathyrus vernus	41,34	19,38	15,46	66,67	J+	J-	J-	III.a.

Leucojum vernum	0,81	1,88	9,28	0,00	J-		J+	
Ligustrum vulgare	37,47	9,38	0,00	0,00	J+	J-	II.b., J-	J-
Lilium martagon	14,05	31,25	18,56	93,33	J-	J+		III.a., J+
Listera ovata	2,65	10,63	1,03	0,00	T-	J+	II.b.	S-
Lithospermum purpureo-coeruleum	4,28	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	
Lonicera alpigena	1,22	25,00	47,42	60,00	J-	J+	J+	III.a., J+
Lonicera caprifolium	12,42	1,88	7,22	20,00	J+	II.b., J-		III.a.
Lonicera nigra	0,00	0,00	12,37	0,00	II.b., J-	II.b.	II.a., J+	
Lonicera xylosteum	3,87	23,13	19,59	86,67	J-	J+	J+	III.a., J+
Luzula albida	6,11	12,50	2,06	0,00		J+	II.b., J-	S-
Luzula forsteri	17,92	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Luzula pilosa	19,14	23,13	6,19	0,00			II.b., J-	S-
Luzula sylvatica	0,81	0,00	10,31	26,67	J-	II.b., J-	J+	III.a., J+
Lychnis coronaria	1,02	0,00	0,00	0,00	II.a.	II.b.	II.b.	
Lysimachia nummularia	7,94	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Majanthemum bifolium	6,72	8,13	9,28	0,00				S-
Malus sylvestris	6,72	3,75	0,00	0,00	T+		II.b., J-	S-
Melampyrum nemorosum	8,15	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Melampyrum pratense subsp. vulgatum	4,28	2,50	0,00	0,00	T+		II.b., J-	
Melampyrum velebiticum	0,00	8,75	0,00	0,00	II.b., J-	II.a., J+	II.b.	
Melica nutans	1,63	9,38	5,15	0,00	J-	J+		S-
Melica uniflora	34,83	0,00	13,40	0,00	J+	II.b., J-	J-	J-
Melittis melissophyllum	22,00	9,38	9,28	73,33	J+	J-	J-	III.a., J+
Mercurialis perennis	36,25	59,38	28,87	73,33	J-	J+	S-	III.a.
Milium effusum	15,27	6,88	12,37	0,00		J-		S-
Moehringia muscosa	0,00	2,50	0,00	0,00	II.b.	II.a., J+	II.b.	
Moehringia trinervia	19,14	5,63	5,15	0,00	J+	J-	II.b., J-	S-
Mycelis muralis	35,85	43,13	50,52	46,67			S+	
Myosotis sylvatica	4,07	1,88	18,56	0,00	T-	T-	J+	S-
Neottia nidus-avis	9,16	39,38	12,37	0,00	J-	J+		S-
Omphalodes verna	0,00	28,13	8,25	0,00	II.b., J-	J+		S-
Origanum vulgare	0,81	0,00	0,00	0,00	II.a.	II.b.	II.b.	
Ostrya carpinifolia	0,61	6,88	0,00	66,67	J-	J+	II.b., J-	III.a., J+
Oxalis acetosella	17,31	40,00	56,70	0,00	J-	J+	J+	J-
Pancicia serbica	0,00	0,00	6,19	0,00	II.b., J-	II.b.	II.a., J+	
Paris quadrifolia	15,48	63,75	62,89	0,00	J-	J+	J+	J-
Phyllitis scolopendrium	1,83	15,63	4,12	0,00	J-	J+		S-
Phyteuma spicatum	0,20	23,13	10,31	0,00	II.b., J-	J+	T+	S-
Picea abies	0,20	25,00	16,49	0,00	J-	J+	J+	S-
Pinus sylvestris	8,76	1,25	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Platanthera bifolia	8,76	51,88	6,19	0,00	J-	J+	II.b.	S-
Poa nemoralis	17,72	1,88	1,03	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Polygonatum latifolium	9,98	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Polygonatum multiflorum	44,40	66,25	9,28	46,67		J+	II.b., J-	
Polygonatum odoratum	9,16	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Polygonatum verticillatum	0,20	0,00	30,93	0,00	II.b., J-	II.b., J-	II.a., J+	S-
Polygonum dumetorum	3,67	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b.	
Polypodium vulgare	2,65	5,63	1,03	6,67		T+	II.b.	
	Constancy (%)				Fidelity			
Species	1	2	3	4	1	2	3	4
Polystichum lobatum	17,52	23,75	44,33	0,00	J-		J+	S-
Polystichum lonchitis	0,00	13,13	17,53	0,00	II.b., J-	J+	J+	S-

Polystichum setiferum	11,20	0,00	1,03	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Populus tremula	1,83	0,63	2,06	66,67	T-	II.b.		III.a., J+
Potentilla micrantha	15,27	2,50	2,06	0,00	J+	II.b., J-	II.b., J-	S-
Prenanthes purpurea	1,43	40,00	41,24	6,67	J-	J+	J+	S-
Primula columnae	1,63	0,00	4,12	0,00		J-	T+	
Primula vulgaris	41,55	17,50	5,15	0,00	J+	J-	II.b., J-	J-
Prunella vulgaris	6,52	3,13	0,00	0,00	T+		II.b., J-	S-
Prunus spinosa	8,76	1,25	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Pteridium aquilinum	14,05	38,13	1,03	0,00	T-	J+	II.b., J-	S-
Pulmonaria officinalis	62,73	40,63	15,46	60,00	J+	J-	II.b., J-	
Pyrola chlorantha	0,00	1,25	7,22	0,00	II.b., J-		J+	
Pyrus pyraster	14,66	5,00	1,03	0,00	J+	J-	II.b., J-	S-
Quercus cerris	22,61	2,50	3,09	66,67	J+	II.b., J-	II.b., J-	III.a., J+
Quercus farnetto	3,26	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b.	
Quercus petraea	58,04	26,25	0,00	66,67	J+	J-	II.b., J-	III.a.
Quercus pubescens	2,04	0,00	0,00	0,00	II.a.	II.b.	II.b.	
Quercus robur	14,66	1,25	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Ramischia secunda	0,00	5,00	0,00	0,00	II.b., J-	II.a., J+	II.b.	
Ranunculus auricomus s.l.	5,91	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Ranunculus lanuginosus	14,26	8,13	25,77	0,00		T-	J+	S-
Ranunculus platanifolius	0,00	0,00	15,46	0,00	II.b., J-	II.b.	II.a., J+	
Rhamnus cathartica	2,24	0,63	0,00	0,00	T+	T-	II.b.	
Rhamnus fallax	0,00	0,00	20,62	46,67	II.b., J-	II.b., J-	J+	III.a., J+
Ribes alpinum	0,00	0,00	1,03	0,00	II.b.	II.b.	II.a.	
Ribes uva-crispa	0,20	2,50	4,12	33,33	J-		T+	III.a., J+
Rosa arvensis	27,09	23,75	0,00	0,00	J+		II.b., J-	S-
Rosa canina	6,31	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Rosa pendulina	0,00	15,00	29,90	20,00	II.b., J-	J+	J+	III.a.
Rubus bellardii	3,26	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b.	
Rubus caesius	6,92	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Rubus hirtus	54,99	52,50	36,08	0,00			S-	J-
Rubus idaeus	1,02	4,38	19,59	0,00	J-		J+	S-
Rubus saxatilis	0,00	0,00	14,43	46,67	II.b., J-	II.b., J-	J+	III.a., J+
Rumex sanguineus	5,30	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Ruscus aculeatus	28,72	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Ruscus hypoglossum	25,46	45,00	5,15	0,00		J+	II.b., J-	J-
Salix caprea	0,81	1,25	6,19	66,67	J-	T-	T+	III.a., J+
Salvia glutinosa	19,96	29,38	2,06	13,33		J+	II.b., J-	
Sambucus nigra	10,59	14,38	1,03	0,00		T+	II.b., J-	S-
Sambucus racemosus	0,00	6,88	7,22	0,00	II.b., J-	J+	J+	
Sanicula europaea	33,20	57,50	37,11	46,67	J-	J+		
Satureja sylvatica	5,30	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Satureja vulgaris	7,94	1,88	0,00	53,33	T+	J-	II.b., J-	III.a., J+
Saxifraga lasiophylla	1,22	0,00	19,59	0,00	J-	II.b., J-	J+	
Saxifraga rotundifolia	1,43	0,63	19,59	0,00	J-	II.b.	J+	S-
Scilla bifolia	9,16	8,75	21,65	0,00			J+	S-
Scrophularia nodosa	17,92	8,75	3,09	0,00	J+		II.b., J-	S-
	Constancy (%)				Fidelity			
Species	1	2	3	4	1	2	3	4
Scrophularia scopolii	2,24	0,00	9,28	0,00		II.b., J-	J+	
Scrophularia vulgaris	1,43	3,75	7,22	0,00	T-		J+	
Scutellaria altissima	3,26	0,00	6,19	46,67		II.b., J-		III.a., J+

Scutellaria columnae	1,83	0,00	0,00	0,00	II.a.	II.b.	II.b.	
Senecio nemorensis et fuchsii	2,44	34,38	23,71	0,00	J-	J+	J+	S-
Senecio ovirensis	0,61	7,50	0,00	0,00	J-	J+	II.b.	
Serratula tinctoria	3,26	3,75	0,00	0,00			II.b., J-	
Sesleria autumnalis	1,22	0,00	1,03	46,67	T-	II.b.		III.a., J+
Silene viridifolia	2,85	0,00	0,00	0,00	II.a., J+	II.b.	II.b.	
Solidago virga-aurea	3,67	26,25	3,09	0,00	J-	J+	II.b., J-	S-
Sorbus aria s.l.	1,83	21,25	4,12	66,67	J-	J+		III.a., J+
Sorbus aucuparia	3,67	12,50	20,62	53,33	J-	T+	J+	III.a., J+
Sorbus torminalis	12,22	10,00	0,00	73,33			II.b., J-	III.a., J+
Spiraea media	0,00	0,00	0,00	60,00	II.b., J-	II.b.	II.b.	I.a.
Spiraea ulmifolia	0,20	3,13	0,00	0,00	T-	J+	II.b.	
Stachys officinalis	2,44	0,00	0,00	0,00	II.a., J+	II.b.	II.b.	
Stachys sylvatica	13,03	1,25	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Staphylea pinnata	17,92	5,00	1,03	20,00	J+	J-	II.b., J-	
Stellaria holostea	48,07	16,25	7,22	33,33	J+	J-	II.b., J-	
Symphytum tuberosum	28,51	47,50	49,48	60,00	J-	J+	S+	III.a.
Syringa vulgaris	0,41	0,00	1,03	0,00		II.b.		
Tamus communis	34,42	28,75	2,06	0,00	J+		II.b., J-	J-
Taraxacum officinale	2,65	0,00	0,00	0,00	II.a., J+	II.b.	II.b.	
Teucrium chamaedrys	0,61	0,00	0,00	0,00	II.a.	II.b.	II.b.	
Thalictrum aquilegifolium	1,83	0,00	0,00	0,00		II.b.	II.b.	
Thymus montanum	2,04	0,00	0,00	0,00	II.a.	II.b.	II.b.	
Tilia argentea	39,92	0,00	1,03	0,00	II.a., J+	II.b., J-	II.b., J-	J-
Tilia cordata	7,13	3,75	1,03	60,00		T-	II.b., J-	III.a., J+
Tilia platyphyllos	15,89	5,00	1,03	0,00	J+	J-	II.b., J-	S-
Torilis anthriscus	3,87	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	
Ulmus campestris	8,35	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Ulmus scabra	23,83	30,63	5,15	0,00		J+	II.b., J-	S-
Urtica dioica	7,13	4,38	3,09	0,00	T+			S-
Vaccinium myrtillus	0,20	0,00	10,31	40,00	J-	II.b., J-	J+	III.a., J+
Valeriana montana	0,00	0,00	4,12	0,00	II.b.	II.b.	II.a., J+	
Valeriana officinalis	0,41	0,00	0,00	0,00	II.a.	II.b.	II.b.	
Valeriana tripteris	0,00	8,75	2,06	0,00	II.b., J-	J+		
Veratrum album subsp. lobelianum	0,00	9,38	40,21	0,00	II.b., J-		J+	S-
Veratrum nigrum	4,89	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	
Veronica chamaedrys	22,81	7,50	9,28	6,67	J+	J-	S-	S-
Veronica hederifolia	5,91	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Veronica latifolia	0,41	8,13	28,87	0,00	II.b., J-		J+	S-
Veronica montana	5,70	0,63	12,37	0,00		II.b., J-	J+	S-
Veronica officinalis	1,83	1,88	0,00	20,00			II.b.	III.a., J+
Viburnum lanata	11,41	17,50	0,00	53,33		T+	II.b., J-	III.a., J+
Viburnum opulus	11,20	11,25	0,00	6,67	T+		II.b., J-	
Vicia oroboides	12,63	34,38	5,15	0,00	J-	J+	II.b., J-	S-
Vicia sepium	3,05	1,88	0,00	0,00	T+		II.b.	
Vinca minor	9,37	1,25	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
	Constancy (%)				Fidelity			
Species	1	2	3	4	1	2	3	4
Viola alba	9,78	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	S-
Viola hirta	2,24	0,63	0,00	0,00	T+	T-	II.b.	
Viola mirabilis	1,83	0,63	1,03	6,67		T-		III.a., J+

Viola odorata	8,15	1,88	0,00	0,00	J+	T-	II.b., J-	S-
Viola riviniana	10,79	7,50	0,00	0,00	J+		II.b., J-	S-
Viola sylvestris	59,06	55,00	52,58	86,67				III.a.
Viola cyanea	4,68	0,00	0,00	0,00	II.a., J+	II.b., J-	II.b., J-	
Waldsteinia geoides	2,85	1,88	0,00	0,00	T+		II.b.	

TABLE 2 - Average constancies of species belonging to different fidelity types.
Abbrevations: Types of fidelity: 1. II.a. type character spesies, 2. species faithful to the syntaxon, 3. species negatively faithful to the syntaxon, 4. II.b. type character spesies, 5. syntaxon faithful to the species, 6. syntaxon negatively faithful to the species, 7. III.a. type character species
Syntaxa: I. Primulo vulgaris – Fagenion, II. Lamio orvalae – Fagenion, III. Lonicero – Fagenion, IV. Ostryo – Fagenion

Syntaxon	type of fidelity	number of species	average constancy			
			I.	II.	III.	IV.
	1	80	8.35	0.21	0.23	0.17
I.	2	87	18.33	8.41	3.65	10.73
	3	78	7.59	22.47	17.76	21.03
	4	36	0.05	8.24	12.49	9.63
	5	114	17.78	5.53	2.56	7.36
	6.	89	6.17	21.87	19.83	18.5
II.	1	4	0	6.25	0	0
	2	84	10.03	29.03	16.27	15.47
	3	53	19.48	7.49	6.05	16.98
	4	134	6.51	0.24	2.96	6.91
	5	79	10.78	30.92	16.87	15.27
	6.	114	15.43	3.57	4.68	10.87
III.	1	9	0.02	0	10.42	0
	2	62	6.42	15.53	25.01	14.73
	3	11	21.24	18.47	9.56	23.64
	4	201	11.76	7.7	1.06	8.06
	5	66	7.88	17.57	27.49	13.23
	6.	153	16.94	11.35	2.52	11.5
IV.	1	1	0	0	0	60
	2	50	6.56	8.58	8.54	50.8
	3	24	36.12	36.51	24.23	1.11
	6	161	14.08	14.2	9.59	0.37
	7	65	12.31	14.03	10.27	52.82