



Numerical approach to the syntaxonomy of plant communities belonging to the class *Festuco-Brometea* in Slovakia

Daniela Micháľková & Jozef Šibík

Institute of Botany, Slovak Academy of Sciences, Bratislava, Slovakia
http://www.ibot.sav.sk



The first complex numerical analysis of the phytocoenological relevés from the class *Festuco-Brometea* is presented. The classification of dry grassland communities in the territory of Slovakia is rather problematic. Incorrectly, there were many only locally based differences in vegetation classified as new associations. This analysis tries to find an objective way of classification at higher vegetation units level (orders and alliances). The partial results are going to be used in the prepared fifth volume of the series of books *Plant communities of Slovakia*. Solving of the nomenclature problems will be our future goal.

A Cluster: *Carex humilis*-rich group

The cluster includes relevés of *Carex humilis*-dominated associations. They were classified inside *Seslerio-Festucion glaucae* or *Festucion valesiacae* by their original authors. The analysis shows there is no need for dividing them into two alliances.



Festuca glauca



Ophrys sphegodes



Verbascum phoeniceum



Minuartia tetra-Festucion pallens

B Cluster: *Festuca pallens*-rich group

Rock-outcrop vegetation with dominant *Festuca pallens* on very thin and discontinuous soil layer. The relevés are most related to the A cluster. There are some floristic similarities but ecological and physiognomic differences are clear

Crambe tatarica



Ranunculus illyricus-Festucion valesiacae

D Cluster: *Festucion valesiacae* Klika 1931
Narrow-leaved dry extensively grazed grasslands. They secondarily occur in the deforested sites. *Festuca ovina* and *F. rupicola* are dominant. The highest concentration of xerophilous plant species. Some endemic species are present.



Brachypodium pinnatifidum



Cirsium pannonicum

E Cluster: *Carduo-Brachypodium pinnatifidum* Mucina et Magločký 1985
Meso-xerophilous sub-continental meadow-steppes dominated with *Brachypodium pinnatifidum*. Many diagnostic species of *Molinio-Arrhenatheretalia* are present. The distribution in Slovakia is in the basins and foothills of the neighbouring mountains formed of crystalline rocks as well as flysch.



Inula oculis-christi

Inula oculis-christi

F Cluster: *Asplenio-Festucion glaucae* Zetvoni 1936
Sub-pannonic dry steppe grasslands on serpentine. The dominant tussock grass is *Festuca pseudodactyloides*. The unit is distributed in the neogene volcanic mountains region located in the central, southern and eastern Slovakia.

Material and methods

The numerical analysis includes 1478 phytocoenological relevés from the class *Festuco-Brometea* stored in the Central Database of Phytocoenological Relevés in Slovakia, (http://ibot.sav.sk/cdb/index.html). They have been collected in the territory of Slovakia during the period 1927–2004 and processed according to the principles of Zurich-Montpellier school (Braun-Blanquet 1964). There were all published data and accessible non-published data used in the analysis.

To obtain the data comparable within the numerical classification, all relevés were transformed into the nine-degree ordinal scale (van den Maarel 1979). The taxa determined only at the level of genus were excluded. Some taxa were classified within the higher or more broadly defined taxa (e.g.).

The CANOCO program (ter Braak & Šmilauer 2002) accomplished the initial data analysis that helped to remove the outlier data. Numerical cluster analysis was performed by the NCLAS program from the SYN-TAX 2000 package (Podani 1993). The β -flexible method ($\beta = -0.25$) with Euclidean distance and Wishart's and Jaccard's similarity coefficients were used. Obtained hypotheses were evaluated by comparison and analysis of phytocoenological tables processed by the FYTOPACK program (Jarolimek & Šklosser 1997).

Each of the six clusters of the synoptic table includes two columns. The column "c" characterises the taxa by their constancy (in % = constancy < 0.5 %) and the mean value of abundance (upper index, in ordinal scale) calculated over the FYTOPACK. The column "f" shows the fidelity in ϕ coefficient multiplied by 100.

The nomenclature of the taxa follows the Checklist of Non-vascular and Vascular Plants of Slovakia (Marhold & Hindák 1998). The names of the syntaxa are according to Mucina & Magločký (1985). Diagnostic taxa of class *Festuco-Brometea* and lower syntaxa follow the publication Chytrý & Tichý (2003).



Carex humilis-Seslerietum calcareae, aspect with *Asterium ranosum*

C Cluster: *Seslerio-Festucion glaucae*

Klika 1931 em. Kolbék 1981

Basiphilous rock-outcrop meso-xerophilous vegetation dominated with *Sesleria varia* and *Carex humilis*.

Perennial and decalpine species are present.



Extensive grazing management in the Slovak Karst NP

Discussion

The plant communities belonging to the continental order *Festucion valesiacae* are well developed in Slovakia. The cluster analysis helped to differentiate the alliances *Seslerio-Festucion glaucae*, *Festucion valesiacae*, *Carduo-Brachypodium pinnatifidum* and *Asplenio-Festucion glaucae*. They are notable characterised by their diagnostic species. On the other hand, the oceanic order *Brometalia erecti* occurs in the studied area, only in fragments. Therefore only small number of relevés (47) was available. The cluster analysis did not differentiate the alliances *Brometalia erecti* and *Coelario-Pheleto phleoidis*. In the dendrogram the data were not gathered together but dispersed over other relevés with the closest species composition possible. For differentiation of these alliances it is necessary to analyse a number of relevés comparable to the rest of the analysed data set, using data from neighbouring middle European countries as well.

Syntaxonomy of the A and B clusters is problematic. Both of them include differential species of *Seslerio-Festucion glaucae* as well as *Festucion valesiacae*. According to the ecology and distribution, the relationship to *Seslerio-Festucion glaucae* is more important though. The possible solution might be classifying them inside this large defined alliance, which is very well developed in the conditions of the Western Carpathians region.

References

- Braun-Blanquet, J. (1964). Pflanzensociologie. Grundzüge der Vegetationskunde. 3. Aufl. Springer Verlag, Wien, 865 pp.
- Chytrý, M. & Tichý, L. (2003). Diagnostic, constant and dominant species of vegetation classes and alliance of the Czech Republic: A statistical revision. Folia Fac. Sci. Nat. Univ. Masaryk. Brno. Biol. 108: 1–231.
- Jarolimek, J. & Šklosser, G. (1997). Fytopack – a system of programs to process phytocoenological tables. Biologia (Bratislava) 52: 53–59.
- Mucina, L. & Magločký, Š. (1985). A list of vegetation units of Slovakia. Docum. Phytosociol. N. S. 9: 175–220.
- Podani, J. (1993). SYN-TAX-PC. Computer Programs for Multivariate Data Analysis in Ecology and Systematics. Ver. 5.0. Scientia Publ. 104 pp.
- ter Braak, C. J. F. & Šmilauer, P. (2002). CANOCO reference manual and CanoDraw for Windows user's guide. Software for canonical community ordination (version 4.5). Biometris, Wageningen & České Budějovice, 500 pp.

Photographs authors:

Daniela Micháľková

Robert Šuková

Abbreviations:

A – *Carex humilis*-rich group, B – *Festuca pallens*-rich group, C – *Seslerio-Festucion glaucae*, D – *Festucion valesiacae*, E – *Carduo-Brachypodium pinnatifidum*, F – *Asplenio-Festucion glaucae*, G – *Asplenio-Festucion glaucae*, H – *Festucion valesiacae*, I – *Asplenio-Festucion glaucae*, J – *Carduo-Brachypodium pinnatifidum*, K – *Asplenio-Festucion glaucae*, L – *Asplenio-Festucion glaucae*, M – *Asplenio-Festucion glaucae*, N – *Asplenio-Festucion glaucae*, O – *Asplenio-Festucion glaucae*, P – *Asplenio-Festucion glaucae*, Q – *Asplenio-Festucion glaucae*, R – *Asplenio-Festucion glaucae*, S – *Asplenio-Festucion glaucae*, T – *Asplenio-Festucion glaucae*, U – *Asplenio-Festucion glaucae*, V – *Asplenio-Festucion glaucae*, W – *Asplenio-Festucion glaucae*, X – *Asplenio-Festucion glaucae*, Y – *Asplenio-Festucion glaucae*, Z – *Asplenio-Festucion glaucae*.