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Alpine heaths in the Western Carpathians – a new approach to the classification

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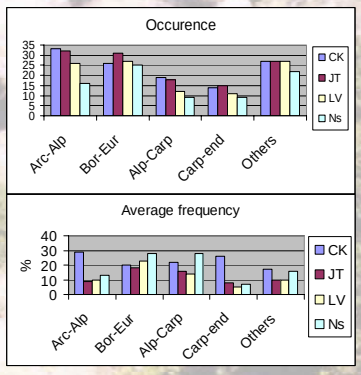
Historical overview

In the Western Carpathians were classified alpine heaths inside large defined class **Juncetea trifidi** (Mucina, Maglocký eds. 1985). This class encompassed various stands on acidic to neutral soils including alpine grasslands on outcrops and flat to steep slopes, and dwarf scrub heaths forming mosaic vegetation with other above mentioned types. Using floristic criterion there were no sufficient differences, though ecological and physiognomic differences were clear on first look. In the period of mapping programs such as Natura 2000, there is optimal (and practical) to recognize stands according their structure and ecological demands, which is connected with nature protection and management plans.

The present delimitation of plant communities follows habitat peculiarities is based according Theurillat et al. (1995) on combination of: 1) the structural homogeneity of all units inside a class, and 2) the floristic similarities. Higher units must be defined with help of additional criteria such as: horizontal and vertical structure, their dominating life and growth forms, which reflect the distinctive ecological conditions (climate, soil) and succession stage.

Structural concept: Structure in phytosociological sense is defined (Rejmánek 1977) as system determined by: 1/ qualitative presence (or absence) of components belonging to defined class (group) e.g. grasses, arcto-alpine taxa, etc.; 2/ quantitative representations of these components e.g. abundance of plant species; 3/ relation among them e.g. spatial pattern, etc.

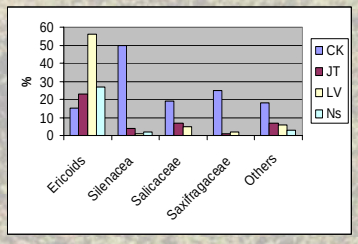


CK Carici rupestris-Kobresietea

JT Juncetea trifidi=Caricetea curvulae

LV Loiseleurio-Vaccinietea

Ns *Nardus*-rich communities



1/ Qualitative parameters

The analyze base on taxa above species-level e.g. family-level shows clear predominance of *Salicaceae*, *Saxifragaceae* and *Silenaceae* in the first group. Taxa such as *Saxifraga bryoides*, *S. moschata*, *S. oppositifolia* and others, as well as *Salix reticulata*, *Minuartia sedoides*, *Silene acaulis* manifest absolute preference in class **Carici rupestris-Kobresietea bellardii.**

On the level of chorology this group is characterized by typical arcto-alpine elements, they related only this class such as geophytes *Lloydia serotina* and *Bistorta vivipara* or hemicryptophytes *Ligusticum mutellinoides*, *Pedicularis oederi*, *Erigeron uniflorus*, rarely also *Comastoma tenellum* and *Oxytropis halleri*.

Boreal elements are typical for grasslands represented here by mezophilous plant species such as *Anthoxantum alpinum*, *Luzula sudetica*, *Ligusticum mutellina*, *Potentilla aurea*, *Geum montanum*, *Hypericum maculatum*, *Gentiana asclepiadea* etc.

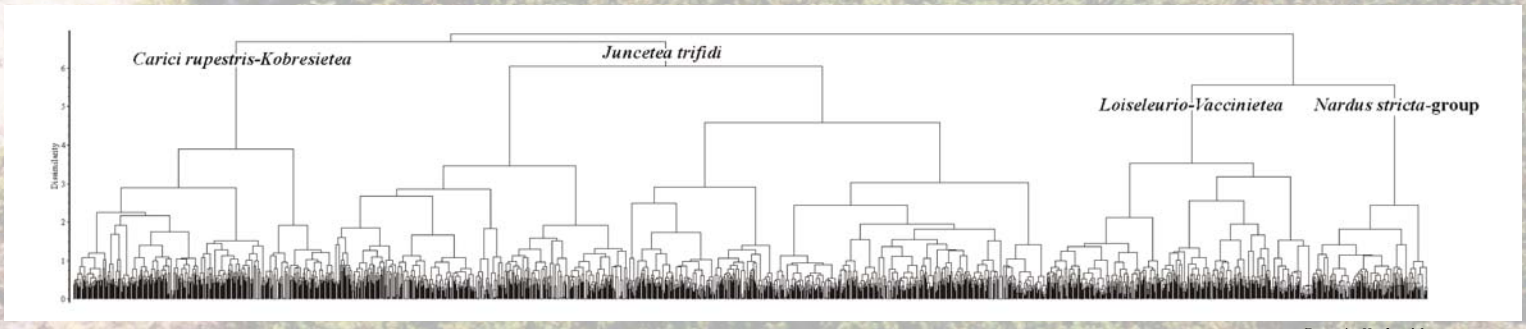
2/ Quantitative parameters

Absence of own character species was reason for unification of the alpine dwarf heaths into largely defined class Juncetea trifidi on the level of alliance. According pure floristic criteria there were no basis for division. Using quantitative parameters (dominance and abundance, biomass) and representation of prevailing life forms (dwarf scrubs) is the division into two classes acceptable and the existence of class **Loiseleurio-Vaccinietea** in Western Carpathians is confirmed.

Dominance of **ericoid dwarf scrubs** characterizes the third group. Vertical structure of plant communities is composed from low scrubs, while role of grasses such as *Juncus trifidus*, *Agrostis rupestris*, *Avenula versicolor* is suppressed. On the other hand the absence or low abundance of grasses such as *Nardus stricta*, *Anthoxantum alpinum*, *Phleum rhaeticum* and other species give reason for division of scrubby vegetation from Nardus-rich grasslands.

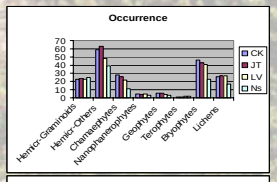
3/ Relational characteristics

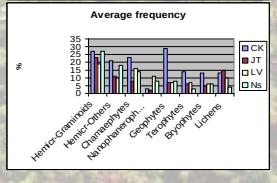
The relation between the above mentioned families and genera and ecological conditions influence spatial arrangement of stands. Snow cover determines the distribution of vegetation types and its extreme values are limiting factor for existence of many plants. Rich lichen and mosses layer in first two groups interacted with small chamaephytes etc., which utilize the cryptogams for protection of seedlings.



Group 1 – Carici rupestris-Kobresietea bellardii Ohba 1974

Chionophobous, cryotemperate dwarf scrubs (*Dryas*, *Salix*), cushion-shaped chamaephytes (*Silene acaulis*, *Minuartia*) and graminoids (*Festuca*, *Kobresia*) on wind-exposed ridges. The soils are calcareous enriched. Holoarctic distribution and highest summits in whole Europa, from Pyrenees to Balkan Mts.





Group 2 – Caricetea curvulae Br.-Bl. 1948 nom. cons. prop. (Syn. Juncetea trifidi Hadač 1946 p. p.).

Alpine grassland-like communities (*Juncus*, *Agrostis*) on windy slopes with lower snow cover. The strictly acidic soils are alpine ranker. Boreal distribution and Alpine-Caucasian Mountain system.

Tab. 1. Differential taxa of the classes *Carici rupestris-Kobresietea* (**A**), *Caricetea curvulae* (**B**), *Loiseleurio-Vaccinietea* (**C**) and *Nardus*-rich communities (**D**)

Column	A	B	C	D
Number of releves	339	926	345	150
Average species number	42	22	20	20
Silene acaulis	76^5	8^3	1^2	2^2
Bistorta vivipara	75^5	23^2	12^2	5^2
Primula minima	64^5	40^3	15^3	1^2
Campanula tatrae	60^5	16^2	10^2	19^3
Festuca versicolor	56^5	4^1	9^2	1^2
Lloydia serotina	56^5	1^2	-	-
Pedicularis oederi	56^5	6^2	1^2	-
Saxifraga moschata	55^5	2^2	1^2	-
Bartsia alpina	53^5	6^2	8^2	-
Saxifraga paniculata	51^5	1^2	2^2	-
Salix kitaibeliana	47^5	5^2	3^2	-
Ligusticum mutellinoides	47^5	2^2	1^2	-
Minuartia sedoides	46^5	2^2	-	-
Pedicularis verticillata	45^5	6^2	3^2	1^1
Rhodiola rosea	42^5	2^2	1^2	1^1
*Luzula * mutabilis*	40^5	2^2	-	1^3
Cerastium eriophorum	37^5	1^2	1^2	-
Carex fuliginosa	35^5	2^2	-	-
Minuartia gerardii	29^5	4^2	-	-
Campanula alpina	61^5	87^5	50^3	32^3
Oreochloa disticha	64^5	78^5	40^3	4^2
Juncus trifidus	46^5	74^5	50^3	17^2
Hieracium alpinum	23^3	62^5	52^3	61^5
Avenula versicolor	29^3	66^5	37^3	53^5
Agrostis rupestris	21^2	60^5	29^3	57^5
Vaccinium myrtillus	22^2	45^3	90^5	80^5
Vaccinium vitis-idaea	37^3	44^3	84^5	27^3
Vaccinium gaultherioides	13^3	17^3	47^5	10^2
Empetrum hermaphroditum	1^2	3^2	48^5	3^2
Nardus stricta	-	4^2	8^2	100^5
Homogyne alpine	15^2	49^3	57^5	84^5
Ligusticum mutellina	22^2	50^3	32^2	77^5
Oreogeum montanum	7^2	30^2	13^2	67^5
Anthoxanthum alpinum	23^3	19^2	17^2	64^5
Potentilla aurea	13^3	34^3	21^2	61^5
*Luzula *rubella*	6^2	6^2	28^3	41^5
Luzula sudetica	7^2	1^2	1^2	25^5
Deschampsia cespitosa	-	1^2	4^2	21^5
Phleum rhaeticum	-	2^2	1^2	19^5
Carex nigra	-	2^2	1^2	15^5

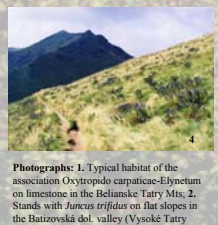
Numerical classification was performed by the program NCLAS from the SYN-TAX 5 package (Podani 1993). The β-flexible method (β = -0.25) with Wishart's similarity coefficients were used. The contents of each column of this table comprise the number of releves used for the synthesis, and the average number of species in the relevant class. Each taxon is characterised by the frequency (in %, + = frequency < 0,5 %) and the mean value of abundance (upper index, in ordinal scale) calculated over the FYTOPACK (Jarolímek, Schlosser 1997).

Group 3 – Loiseleurio-Vaccinietea Eggler ex Schubert 1960

Supratimberline, ericoid dwarf scrubs communities on slopes with various snow cover. Type of soils is ranker and podzols. Circumpolar distribution.

Group 4 – *Nardus*-rich communities

Mountain to alpine grassland-like communities (*Nardus*, *Agrostis*) on slopes with moderately long snow cover. The soils are acidic alpine rankers and podzols. Boreal distribution.



Photographs: 1. Typical habitat of the association Oxytropido carpaticae-Elynetum on limestone in the Belianske Tatry Mts; **2.** Stands with *Juncus trifidus* on flat slopes in the Batizovská dol. valley (Vysoké Tatry Mts); **3.** Dwarf scrub *Empetrum hermafroditum* in the Malá Fatra Mts; **4.** *Nardus*-rich grasslands in the Malá Fatra Mts. **5.** *Loiseleuria procumbens* - rare taxon in the Western Carpathians.

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