

# PLANT COMMUNITIES WITH *PINUS MUGO* IN THE ROMANIAN CARPATHIANS



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## INTRODUCTION

*Pinus mugo* is generally considered to be a heliophilous pioneer species, but it is often found in extreme sites to which it has been relegated by other competitors.

Dwarf pine (*Pinus mugo* s. str.) is a shrub that reaches the optimum of its distribution above the timberline in the Eastern and South-Eastern Alps, the Northern and Central Dinarides, the high mountains of the Balkan Peninsula (the Rhodopes, Rila Mts, Pirin Mts) and the Carpathians. Smaller, isolated populations occur in the Jura Mts, Vosges Mts, Šumava Mts, Jizerské hory Mts and Krkonoše Mts; the most southerly isolated occurrence is in the Abruzzi Mts in the Apennines. In most of these mountains, the dwarf pine shrubs form a coherent, climatically conditioned vegetation belt, mostly known as the subalpine belt. Less often *Pinus mugo* s. str. occurs on hygrophilous stands on peaty soils in lower altitudes (montane and lower subalpine belt) as azonal vegetation type.

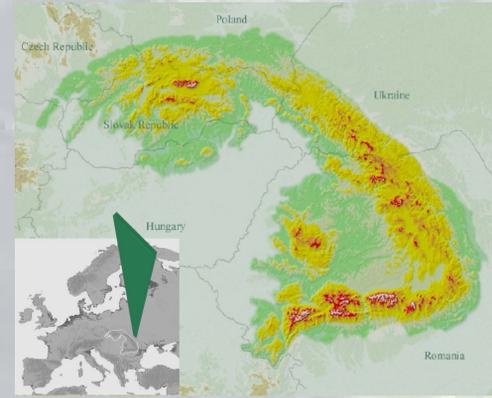


Fig. 1. Localization of the Carpathians within Europe.

## MATERIAL AND METHODS

The relevés for this study were obtained from the (alti-montane) subalpine belt of the Carpathians (Slovakia, Poland, Romania and Ukraine) – Fig. 1, Krkonoše Mts and Šumava Mts (the Czech Republic, Poland), the Eastern and South-Eastern Alps (Austria, Italy, Switzerland), the Apennines (Italy), the Dinarides (Croatia, Slovenia) and the Rila Mts (Bulgaria).

All relevés were sampled following the standard procedures of the Zürich-Montpellier School (Braun-Blanquet 1964), frequently using the modified 9-degree Braun-Blanquet's sampling scale (Barkman et al. 1964) and were stored in a TURBOVEG database (Hennekens & Schaminée 2001). The data were exported into JUICE 6.4.6 software (Tichý 2002) for analysis. For detailed information about methods and results see papers by Šibík et al. (2008) and Šibík et al. (2010).

## RESULTS AND CONCLUSIONS

According to altitudinal, edaphic, moisture or geographic gradients the zonal *Pinus mugo*-communities can be divided into four general ecological types:

- a dry, rocky type on basiphilous bedrock;
- a moist type on nutrient-rich soils on basiphilous, as well as silicate bedrock;
- an acidophilous, oligotropic, species-poor type;
- an oligotropic, windswept type at the transition between the subalpine and alpine belt on silicate bedrock - Fig. 2, 3.

Based on the occurrence of individual floristic elements, geographical variability was classified either at the association or subassociation level. In the European area, 17 associations are distinguished; 6 of them occur in the Carpathians [the *Cetrario islandicae-Pinetum mugo* Hadač 1956, the *Dryopterido dilatatae-Pinetum mugo* Unar in Unar et al. 1985, the *Rhododendro myrtifolii-Pinetum mugo* Coldea 1991, the *Adenostylo alliariae-Pinetum mugo* (Sillinger 1933) Šoltésová 1974, the *Seslerio albicans-Pinetum mugo* (Šoltésová 1974) Šibík in Jarolímeček et Šibík 2008, and the *Seslerio haynaldianae-Pinetum mugo* Šibík et al. 2010] – Table 1. Floristic characteristics, site conditions, distribution and nomenclature are described in detail in papers Šibík et al. (2008) and Šibík et al. (2010).

Taking into account the obtained knowledge, the limited vertical distribution (the subalpine belt) of studied phytocoenoses, similar physiognomy, and mutual close syngenetic relationships between individual dwarf pine associations, we confirm their current classification within one alliance *Pinion mugo* Pawłowski in Pawłowski et al. 1928, order *Junipero-Pinetalia mugo* Boşcaiu 1971 and one class *Rosopendulinae-Pinetea mugo* Theurillat in Theurillat et al. 1995.

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Fig. 2. DCA ordination diagram of recent relevés dominated by *Pinus mugo* from the Eastern and Southern Carpathians.

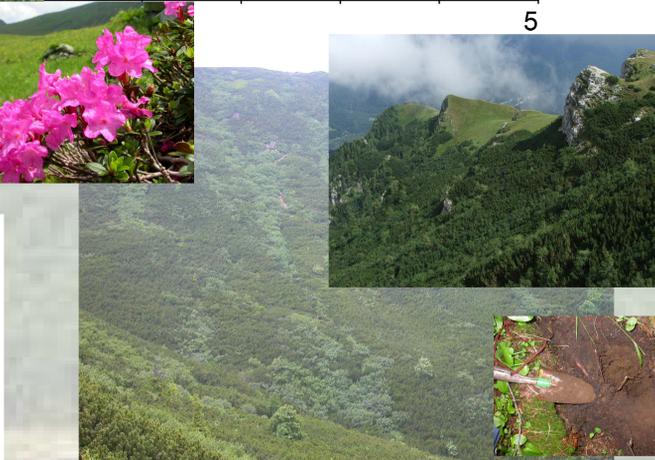
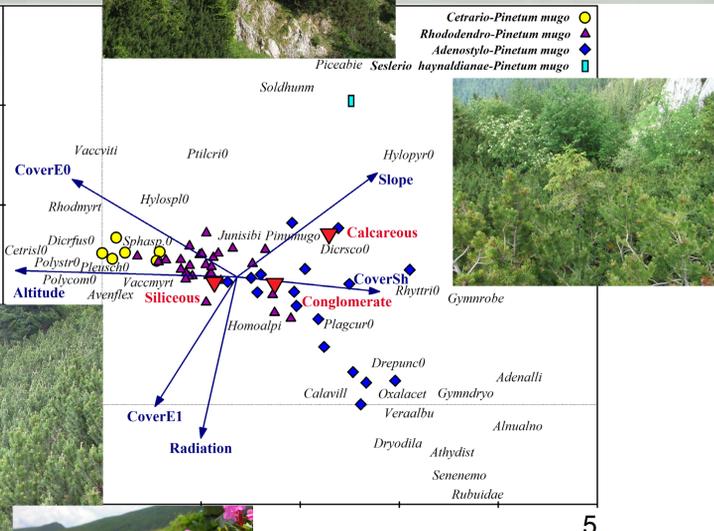


Fig. 3. Dendrogram of the numerical classification of the plant communities of the Pinion mugo in the Carpathians and Rila Mts based on the synoptic table. Used parameters:  $\beta$ -flexible ( $\beta = -0.25$ ) method with Ružička's similarity coefficient. For the explanations see Table 1. - numbers in the brackets.

The azonal vegetation type represents only one type similar for the whole area of European mountains – slightly woody raised bogs and their margins in (montane) subalpine areas of European mountains, that called *Sphagno magellanici-Pinetum mugo* Hadač, Ježek et Březina 1969 nom. cons. propos. from the class *Vaccinio uliginosi-Pinetea sylvestris* Passarge 1968.

Table 1 Syntaxonomical evaluation of dwarf pine shrub communities respecting ecological and chorological criteria proposed by authors.

Class	Order	Alliance	Habitat			Soil			Vegetation			Class	Order	Alliance					
			Steep, rocky habitats, mosaic with montane and alpine calcareous oaks of the <i>Elyso-Seslerio</i> and rocky fissures	supramontane - lower subalpine	calcareous	supramontane - subalpine	mainly siliceous	Windswept places, pleistocene granite screes, mosaic with acidiphilous grasslands of the <i>Cetrario carolinensis</i>	higher subalpine - alpine	siliceous	Azonal, raised bogs, near mountain lakes, mosaic with communities of the <i>Oxycocco-Sphagnum</i>								
			Nutrient requirements	entrophic	calcareous	nitrophilous	oligotrophic, strongly acidiphilous	oligotrophic	oligotrophic, peaty										
			Area	middle, tall (0.2) 1 - 2 m		tall (1.5) 1.8 - 2.5 (3) m	tall (1) 1.8 - 2.5 (4) m	low - 0.2 - 1 m	low, tall - 0.2 - 2 m										
Rosopendulinae-Pinetea mugo	Junipero-Pinetalia mugo	Pinion mugo	Western Carpathians	<i>Seslerio albicans-Pinetum mugo</i> (2)	<i>Adenostylo alliariae-Pinetum mugo</i>	<i>Dryopterido dilatatae-Pinetum mugo</i>	<i>Cetrario islandicae-Pinetum mugo</i>	<i>Sphagno magellanici-Pinetum mugo</i>											
			Sudetes mountains		<i>Adenostylo alliariae-Pinetum mugo</i>	<i>Dryopterido dilatatae-Pinetum mugo</i>	<i>Cetrario islandicae-Pinetum mugo</i> (var)	<i>Sphagno magellanici-Pinetum mugo</i>											
			Ukrainian Carpathians		<i>Adenostylo alliariae-Pinetum mugo</i>	<i>Dryopterido dilatatae-Pinetum mugo</i>	<i>Cetrario islandicae-Pinetum mugo</i> (var)	<i>Sphagno magellanici-Pinetum mugo</i>											
			Romanian Carpathians	<i>Seslerio haynaldianae-Pinetum mugo</i> (1)	<i>Adenostylo alliariae-Pinetum mugo</i>	<i>Dryopterido dilatatae-Pinetum mugo</i>	<i>Cetrario islandicae-Pinetum mugo</i>	<i>Sphagno magellanici-Pinetum mugo</i>											
					<i>Adenostylo alliariae-Pinetum mugo</i>	<i>Dryopterido dilatatae-Pinetum mugo</i>	<i>Cetrario islandicae-Pinetum mugo</i>	<i>Sphagno magellanici-Pinetum mugo</i>											
					<i>Adenostylo alliariae-Pinetum mugo</i>	<i>Dryopterido dilatatae-Pinetum mugo</i>	<i>Cetrario islandicae-Pinetum mugo</i>	<i>Sphagno magellanici-Pinetum mugo</i>											
					<i>Adenostylo alliariae-Pinetum mugo</i>	<i>Dryopterido dilatatae-Pinetum mugo</i>	<i>Cetrario islandicae-Pinetum mugo</i>	<i>Sphagno magellanici-Pinetum mugo</i>											
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		<i>Adenostylo alliariae-Pinetum mugo</i>	<i>Dryopterido dilatatae-Pinetum mugo</i>	<i>Cetrario islandicae-Pinetum mugo</i>	<i>Sphagno magellanici-Pinetum mugo</i>														
Erico-Pinetalia	Erico-Pinetalia	Pinion mugo	Danube	<i>Rhododendro ferrugineum-Pinetum mugo</i>	<i>Lonicera borbasiana-Pinetum mugo</i>	<i>Hyperico grisebachii-Pinetum mugo</i> s. l.?													
			the Alps	<i>Rhododendro ferrugineum-Pinetum mugo</i> (var)	<i>Rhododendro ferrugineum-Pinetum mugo</i>	<i>Rhododendro ferrugineum-Pinetum mugo</i>													
Epipactido-Pinetea mugo	Epipactido-Pinetea mugo	Pinion mugo	the Apennines	<i>Polygala chamaebuxus-Pinetum mugo</i>															
				<i>Orchis secundae-Pinetum mugo</i>															

ACKNOWLEDGEMENT: This work was supported by the grant agency VEGA 2/0121/09 and by the Institute of Biology Romanian Academy for Inter-academic exchange in the years 2004-2009. We are grateful to C. Bița, A. Košuthová-Dingová, I. Jarolímeček, J. Kochjarová, J. Košťál, M. Onete, M. Perný and M. Valachovič for the pleasant field-work collaboration. Our thanks also go to Gh. Coldea, I. Jarolímeček and M. Valachovič for providing their unpublished phytosociological relevés.