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Distribution and communities of *Holcus mollis* in the Polish Tatra mountains and northern sub-Tatra region

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Abstract. In the paper a detailed characteristic of altitudinal and horizontal distribution of *Holcus mollis* in the Polish Tatra Mts. and adjacent sub-Tatra Region is given. Also, siteconditions and plant communities, as well as the distribution pattern of the *Holcetum mollis* association in the area under study, are characterized.

Key words: Holcus mollis, Tatra Mts., sub-Tatra region, distribution pattern, altitudinal range, plant communities, biochore

Introduction

Although *Holcus mollis* is, in general, not a rare species in the Carpathians, its presence in the vegetation of the Tatra Mts and sub-Tatra region is not so clearly visible. The information on species distribution and on plant communities in which it grows there is almost completely lacking. It is also significant to notice that the species was not reported in the comprehensive "Flora" of the Polish Tatra Mts. by Kotula (1890). The present paper provides detailed data on altitudinal and horizontal distribution of *Holcus mollis* in the Polish Tatra Ms. and in northern sub-Tatra region (Fig. 1), and characterizes its phytocoenoses there.

Material and methods

The elaboration encompasses the northern sub-Tatra region area. The species distribution was investigated in 1980-1983. Detail mapping (Fig. 1) was only done in the area, in which occurrence of the species was noted. Habitats, in which *B. orientalis* occurs, were characterized by soil texture, humidity, and reaction (pH in H_2O and in KCl). Syntaxonomical status of the species was characterized from 15 releves according to Braun-Blanquet's method. Species nomenclature follows Mirek *et al.* (1995).

Results and discussion

Distribution and altitudinal range

Detailed investigations, both floristical and phytocoenotical, which have been performed by the author revealed that *Holcus mollis* is a common species in sub-Tatra region but it is rare in the Tatra Mts (Fig. 1). Its stands in the Tatra Mts are scattered from foothills to the upper forest limit, which it overcomes only sporadically (one stand). *Holcus mollis* reaches its altitudinal maximum in the Dolina Stawów Gąsienicowych Valley at 1,620 m above sea level. The near stands in Hala Gąsienicowa clearing (Stawiańskie Rówienki and Królowe Rówienki) are localized at 1,480 m and 1,520 m a.s.l respectively. However, the most of localities (96%) do not overcome 1,400 m a.s.l. (Fig. 1). This type of altitudinal

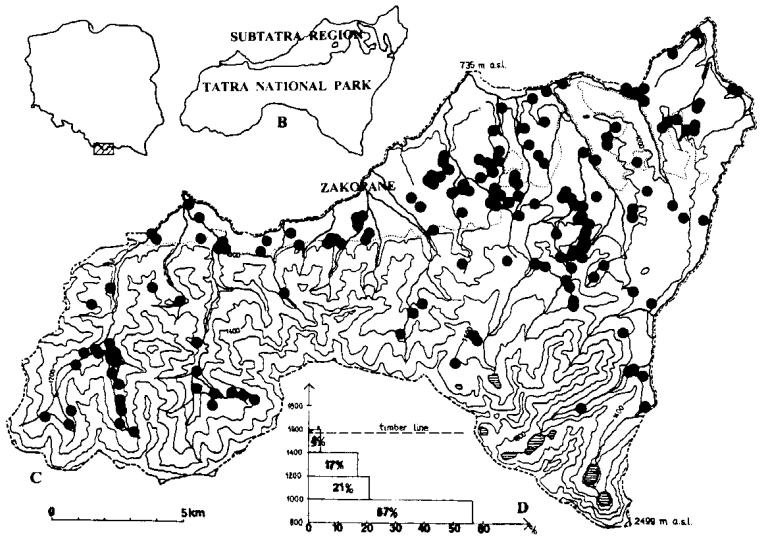

Fig.1. Horizontal (C) and vertical (D) distribution of *Holcus mollis* in the Polish Tatra Mts and adjacent northern sub-Tatra region. A - location of the investigated area on the map of Poland, B - relations betweenTatra National Park and sub-Tatra region.

Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Ch. association																											
Holcus mollis	5	5	4	5	5	3	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	4	5	4	5
Ch. Arrhenatheretalia i Molinio-Arrhenatheretea																											
Veronica chamaedrys																							1	1	2	2	+
Alchemilla sp.															1			+				1	3			1	3
Poa pratensis						1																	r				1
Trisetum flavescens																						r					+
Poa trivialis																									1		+
Ch. Nardion, Nardo-Callunetea																											
Potentilla aurea	1				+				+		3				+				+				+				1
Deschampsia flexuosa	+	1	+	+												+											
Nardus stricta		1	+		1													+									
Ch. Epilobietea angustifolii																											
Rubus idaeus									+						2	3	1	1	2	+							
Chamaenerion angustifolium															+				r	r							
Accompanying species																											
Rumex alpestris	3	2	2	2	2		3	3	4	3	3	2				2	3			+	3	2	3	3	1	1	3
Hypericum maculatum	+	2	2				+	3		1			1	1				1		r	2	+	3	+			1
Mutellina purpurea	+	1		+					4	3	3	1			+	+			+		+		3				
Agrostis capillaris	+	+				+	1	1			+				1					+			1	+	1		3
Stellaria graminea			2				1	1										+			1	1	2	+	2		+
Galeopsis bifida		+			1				+	1		2									4	2			3		
Deschampsia caespitosa	+			+	+	+						1						+					+				
Phleum commutatum	+										+							+									+
Senecio nemorensis							r					+		+													
Luzula luzuloides		+				+													+	r							
Festuca rubra		+			+	2		+	+						+			+		+							1
Rumex acetosella						+		1					1	+	+			1		+							
Carex leporina	+	+				1		1							+			1					r				
Polygonum bistorta	+					r	+		+												+						r
Senecio subalpinus												+		+								1	2			+	+
Ranunculus repens																						1		+	3	2	
Chaerophyllum hirsutum							+																	3		1	
Cirsium arvense																						r			+		

Table 1. *Holcetum mollis* and its differentiation in the Polish Tatra Mts. Other species: *Agropyron repens* 17, *Agrostis gigantea* 26, *Alopecurus pratensis* 17(1), *Campanula patula* 6(1), *Campanula polymorpha* 16, *Cardaminopsis halleri* 6, *Carex nigra* 5, 15, *Carex pallescens* 18, *Carex pilulifera* 17, *Carum carvi* 6, *Cerastium holosteoides* 6(1), *Galeopsis tetrahit* 27(1), *Galium saxatile* 6(2), *Gentiana asclepiadea* 1, *Gentiana punctata* 1, *Juncus conglomeratus* 7, *Juncus effusus* 13, 15, *Leucanthemum waldsteinii* 6, *Luzula multiflora* 6, 15, *Luzula spicata* 1, *Luzula sylvatica* 4, 14, *Lychnis flos-cuculi* 6(2), *Phleum pratense* 6(1), 13, *Potentilla erecta* 14, *Ranunculus acris* 6(2), *Salix silesiaca* 7, *Solidago alpestris* 1, *Stellaria nemorum* 27(3), *Taraxacum officinale* 6, *Trifolium repens* 6(1), *Urtica dioica* 27(2), *Vaccinium myrtillus* 8, 16, *Vicia cracca* 24, *Viola tricolor* 6(1).

Localities: 1 (406) Polana Waksmundzka, 2 (509) Wyżnia Smreczyńska Polana, 3 (578) Mała Polanka Ornaczańska, 4 (555) Wielka Polana Ornaczańska, 5 (501) Wyżnia Smreczyńska Polana, 6 (927) Polana Chochołowska, 7 (179) Równieńki - Wielka Polana, 8 (566) Niżnia Smreczyńska Polana, 9 (553) Wielka Polana Ornaczańska, 10 (545) Wielka Polana Ornaczańska, 11 (688) Staroróbociańska Równień, 12 (497) Królowe and Stawiańskie Równieńki, 13 (709) Jarząbcze Szałasiska, 14 (654) western slope of the Przednia Kopa Sołtysia (clearing), 15 (37) Wyżnia Jarząbcza Polana, 16(448) Królowe and Stawiańskie Równieńki, 17(253) Polana Iwanówka, 18 (39) Wyżnia Jarząbcza Polana, 19 (708) Równień za Wodą, 20 (332) Niżnia Goryczkowa Równień, 21 (538) Wielka Polana Ornaczańska, 22 (633) Przednia Sołtysia Kopa, 23 (581) Mała Polanka Ornaczańska, 24 (201) Wyżnia Polana Pisana, 25 (616) Płaśnia, 26 (869) Polana Kasprowa, 27 (138) Wyżnia Palenica Pańszczykowa. Numbering of localities follows head of the table (in brackets - field releve number). Nomenclature after Mirek et al. (1995).

distribution enables to classify *Holcus mollis* as lowland-montane species (Mirek 1990). Localities of the species are scattered all over the Tatra Mts. (excluding altitudes above timberline), however it is distinctly more frequent on areas build up with flysh and non-calcareous rocks. Because it is an acidophilous species it avoids shallow soils developed on calcareous bedrock. In the Tatra Mts. it may be found more frequently only in upper parts of the Dolina Chochołowska and Dolina Kościeliska valleys, and in the Kopy Sołtysie Massif. Present distribution becomes apparent while comparing with lack of the species in the Polish Tatra Mts. stated by Kotula (1890) a hundred years ago. Quite similar was the situation in the whole Tatras, from where Kotula (1890) reported only two localities found at the lowest situations in the Slovakian part of the mountains. Present distribution of *Holcus mollis* in the Polish Tatra Mts is restricted only to abandoned pasture glades, which existed also in Kotula's times. So, it is hardly to say that this outstanding botanist, penetrating all places of species' present distribution (excluding Kopy Sołtysie) might overlook virtually all localities of the species. It gives rather supposition that *Holcus mollis* has appeared in the Polish Tatra Mts recently, or at least it has spread there and become more abundant thus easily visible. Such a change may be connected with abandoning of sheep grazing at most glades in the Polish Tatra Mts in the end of sixties. When ceased grazing and organic fertilisation some meadow communities and pastures have started to change due to natural succession processes.

Plant communities and habitats. The species occur, in the area investigated, in two main types of plant communities. These are: the *Holcetum mollis* association and internally differentiated group of segetal communities, in which *Holcus mollis* is a faithful component. In the Tatra Mts, as it was already mentioned, *Holcus mollis* builds up its own association *Holcetum mollis* (Table 1), in stands of which it is a dominating plant (covering as a rule

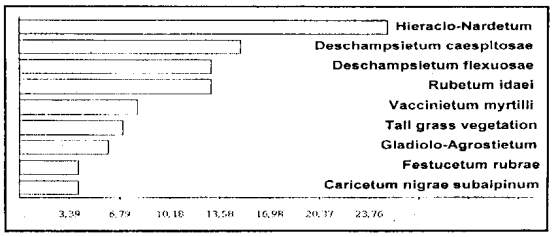

Fig. 2. Frequency of "neighbour associations" *Holcetum mollis* (50 biochores) in the Polish Tatra Mts.

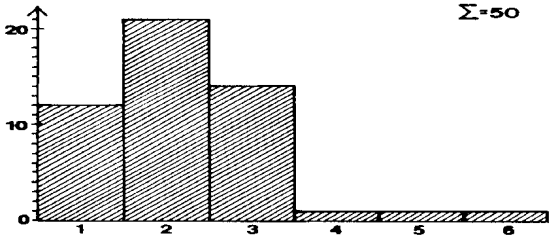

Fig. 3. Frequency of contact of 50 *Holcetum mollis* biochores with various number of assocations in the Polish Tatra Mts.

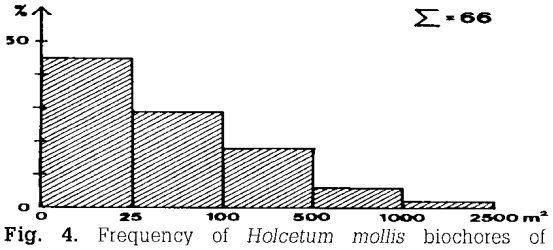

Fig. 4. Frequency of *Holcetum mollis* biochores of different size in the Polish Tatra Mts.

Number of records	3	13	23
Groups of species	Constancy in various communities		
	Solanum fiedls	*Trifolium* fiedls	Crop fiedls
Holcus mollis	V	III	IV
Species characteristic of *Solanum tuberosum* fields			
Gnaphalium uliginosum	IV		
Polygonum hydropiper	II		
Species characteristic of *Trifolium pratense* fields			
Daucus carota		V	
Lolium perennae		IV	
Lolium multiflorum		I	
Medicago lupulina		IV	
Melandrium album		V	
Plantago lanceolata		V	
Rumex obtusifolius		II	
Matricaria maritima subsp. inodora		III	
Species characteristic of crop fields			
Agrostis gigantea			III
Centaurea cyanus			II
Festuca pratensis			III
Galeopsis bifida			IV
Mentha arvensis			II
Polygonum persicaria			V
Spergula arvensis			IV
Vicia angustifolia			
Vicia hirsuta			II
Vicia sativa			
Vicia villosa			
Common species			
Achillea millefolium	IV	IV	IV
Agropyron repens	V	IV	III
Anthemis arvensis	V	V	IV
Brassica rapa	II	III	II
Campanula rapunculoides	IV	II	III
Capsella bursa-pastoris	IV	III	I
Galeopsis tetrahit	V	IV	V
Heracleum sphondylium	II	IV	III
Lapsana communis	V	III	III
Myosotis arvensis	II	V	III
Poa annua	IV	IV	II
Fallopia convolvulus	IV	II	II
Ranunculus repens	II	V	V
Rapahnus rapahanistrum	V	III	IV
Rumex acetosella	IV	II	II
Rumex acetosa	IV	I	II
Stellaria media	V	V	IV
Taraxacum officinale	II	IV	II
Trisetum flavescens	II	IV	I
Vicia cracca	II	IV	III
Vicia sepium	II	IV	II
Viola tricolor	II	IV	II
Scleranthus annuus	V	I	I
Galium aparine	II	II	II
Ranunculus acris	II	II	I
Veronica arvensis	II	II	I
Equisetum arvense	II	II	I
Equisetum silvaticum	II	II	II
Alchemilla crinita		II	III
Campanula patula		IV	II
Dactylis glomerata		IV	II
Geranium pusillum		III	I
Lathyrus pratensis		II	I
Leucanthemum vulgare		III	II
Phleum pratense		V	II
Poa trivialis		IV	III
Rumes crispus		II	II
Stellaria graminea		II	III
Trifolium repens	II	IV	V
Veronica persica	II	II	
Cerastium glomeratum			I

Table 2. *Holcus mollis* in segetal communities of the sub-Tatra region (based on unpublished data collected by the author).

75-100%). The association belongs to the dynamic circle of secondary communities and is one of the seral stages in a succession series from poor, acid meadows to clearing communities and then to the forest. *Holcetum mollis* develops on poor, fresh or wet soils in the complex of communities dominated by *Nardus stricta*, or poor fresh meadows, and some secondary types of tall-grass communities. All these are potential sites of fir- or spruce forests. The composition of the association and its differentiation are given in Table 1. This differentiation is connected with site fertility, moisture, and stage of succession. In spite of its grassy character *Holcetum mollis* should be classified as clearing community, taking into consideration its position in the dynamic circle of communities. On the type of habitats and syndynamical position of the association indirectly inform also accompanying communities. Here are: the *Hieracio alpini-Nardetum, Deschampsietum flexuose* and poorer variants of fresh meadow *Gladiolo-Agrostietum*, and *Deschampsietum caespitosae, Rubetum idaei* and *Vaccinietum myrtilli* (Fig. 2). To these "contact" associations clearly correspond distinguishable forms of the *Holcetum mollis* (Table 1). Biochores of the *Holcetum mollis* are mostly small, hence they contact in the field with few other communities - often with one to three, and only sporadically with four, five or six (Fig. 3). Some a half of the biochores of the *Holcetum mollis* found in the Tatra Mts do not exceed 25 m^2, and ca 80% - 100 m^2 (Fig. 4). Only one stand had more than 1,000 m^2. It is localised in Wyżnia Polana Ornaczańska glade and attains ca 2,500 m^2 (Fig. 5). In the Sub-Tatra Region the *Holcetum mollis* association is rare, and *Holcus mollis* occurs here mainly in segetal communities.

Segetal communities accompany crop fields in the whole area of the Sub-Tatra region from foothills (750 m) to the highest elevations of the Wzniesienie Gubałowskie range, i.e. at ca 1,150 m. At present there are no crop fields in the Tatra Mts, however they occurred here in the past (until the beginning of sixties) in some montane glades. Segetal communities in the sub-tatra region vary depending on a crop they accompany. Somewhat different composition of species is found in crops of potato *Solanum tuberosum*, cereal crops (mainly oat and rye), and in clover crops (Table 2). In all types of segetal communities mentioned •*Holcus mollis* occurs with high constancy (III-V), what is clearly visible in the Table 2 comprising 40 phytosociological releves collected in recent years. Similarly, in 1950-th the species was frequent in this region (Wzniesienie Gubałowskie), where it additionally accompanied flax fields (Grodzińska 1961). Presently, the latter are quite absent in the Sub-Tatra region (Mirek 1993). It is worthy to mention that insofar in the *Holcetum mollis Holcus mollis* is the dominating species (75-100% of cover), as in the segetal communities it never exceeds 50% of cover. It also turns one's attention the high percentage of flowering stems of *Holcus mollis* in the segetal communities and their negligible share in the *Holcetum mollis*.

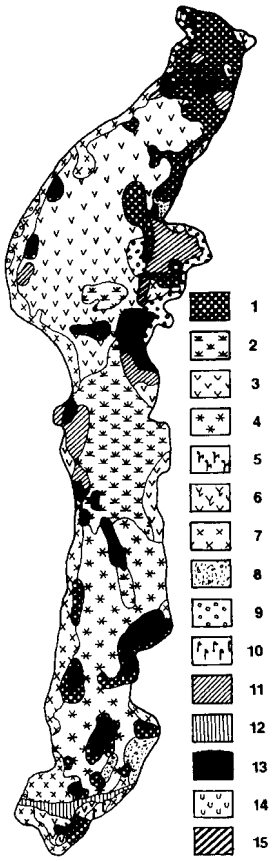

Fig. 5. Pattern of distribution of *Holcetum mollis* biochores in Wielka Polana Ornaczańska clearing in the Polish Tatra National Park (according to Mirek Z. & Holeksa J. unpubl.).1 - Holcetum mollis, 2 - Deschampsietum caespitosae, 3 - Festucetum rubrae, 4 - Deschampsietum flexuosae, 5 - Calamagrostietum villosae, 6 - Luzuletum nemoralis, 7 - Hieracio alpini - Nardetum, 8 - Caricetum nigrae subalpinum,- Vaccinietum myrtilli, 10 - Glycerietum fluitantis, 11 - Rubetum idaei, 12 -Plantaginetea majoris, 13 - Rumicetum alpini, 14 - Urticetum dioiceae, 15 - spruce forest.

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