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Vegetation studies on rocky grasslands in the Pilis Mountains Hungary

By
T. SZERDAHELYI

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Abstract: Cenological investigations on rocky grasslands have been carried out in two sites of the Pilis Mountains in its limestone range. At each of the two sites 25 samples have been examined and compared with each other according to their floral elements, ecological requirements, life-forms and cenological characters. The divergence of the floristic list of two groups has been explained by degradation processes. The data were analysed by cluster analysis with the help of computer.

INTRODUCTION

The main aim of the Pilis Biosphere Reserve is to preserve the various biotic communities for the future. There are several rocky grassland communities with various species composition on the southwest limestone slopes of the Pilis Mountains. Having originated in the Triassic and having cracked in the Tertiary period, the slopes and cliffs presented various possibilities for the formation of rocky grassland communities. It is possible to compare this long rocky grassland zone (about 14 km) with spots of similar character. The unbroken oak-forest (Quercetum petraeae-cerris) at the top of the slope is fragmented gradually and rocky grassland association patches are organized. The size of these fragments is to a great extent influenced by the microrelief. Treeless communities start from here on xerophilous spots.

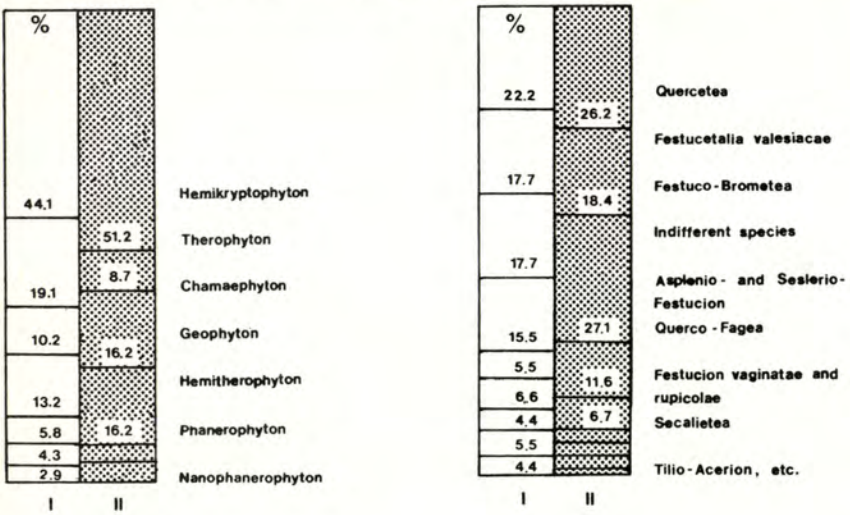
We marked two areas in this rocky grassland vegetation similar to each other in many characters. These sample plots belong to the Cleistogeno-Festucetum rupicolae association (SOÓ 1964-1980). SOÓ presented data about this association from the Keszthelyi Mountains, of a "Carex humilis-Festuca sulcata-Stipa joannis association complex" (1930). Later POLGÁR gave a floristic list from a similar association (1933). MÁTHÉ's vegetation studies (1956) provided several detailed pieces of about this association. ZÓLYOMI published in his paper (1958) a floristic list from a "Diplachno-Festucetum sulcatae matricum" association of the Budai Mountains.

The object of my study was to examine how changes of the environmental complex influence the changes in the species composition of the rocky grassland community.

MATERIAL AND METHOD

The first sample area (I) is close to the "Klastrom-szirtek", where 25 quadrates each of 1x1 m were sampled to the BRAUN-BLANQUET method (1964). It was presumed that the changes in the species composition of the rocky grassland community were caused by the excessive mouflon stock. Certainly there are many wild animal tracks in this area. The second

sampling area (II) is close to "Öreg-szirt". The surroundings of the "Öreg-szirt" is similar to that around the "Klastrom-szirtek" but I did not find any signs of damage caused by wild animals or any marks of degradation. These sample plots are here considered as a control area. Twenty-five quadrates were sampled here, too (see Table).



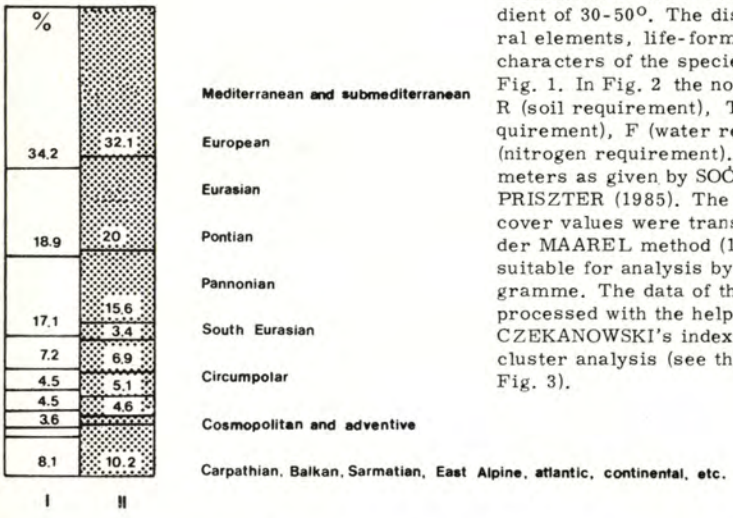


Fig. 1 Distribution of life-forms, cenological characters and phytogeographical spectrum in the two sampled areas

The data were collected from May to September. Exposition of the slope was southwest and south-southwest with a gradient of 30-50°. The distribution of the floral elements, life-forms and cenological characters of the species can be seen in Fig. 1. In Fig. 2 the notation is as follows: R (soil requirement), T (temperature requirement), F (water requirement) and N (nitrogen requirement). We used this parameters as given by SOÓ (1964-1980) and PRISZTER (1985). The BRAUN-BLANQUET cover values were transformed by the van der MAAREL method (1979) to render them suitable for analysis by a computer programme. The data of the sample plots were processed with the help of computer, using CZEKANOWSKI's index of similarity in a cluster analysis (see the dendrogram in Fig. 3).

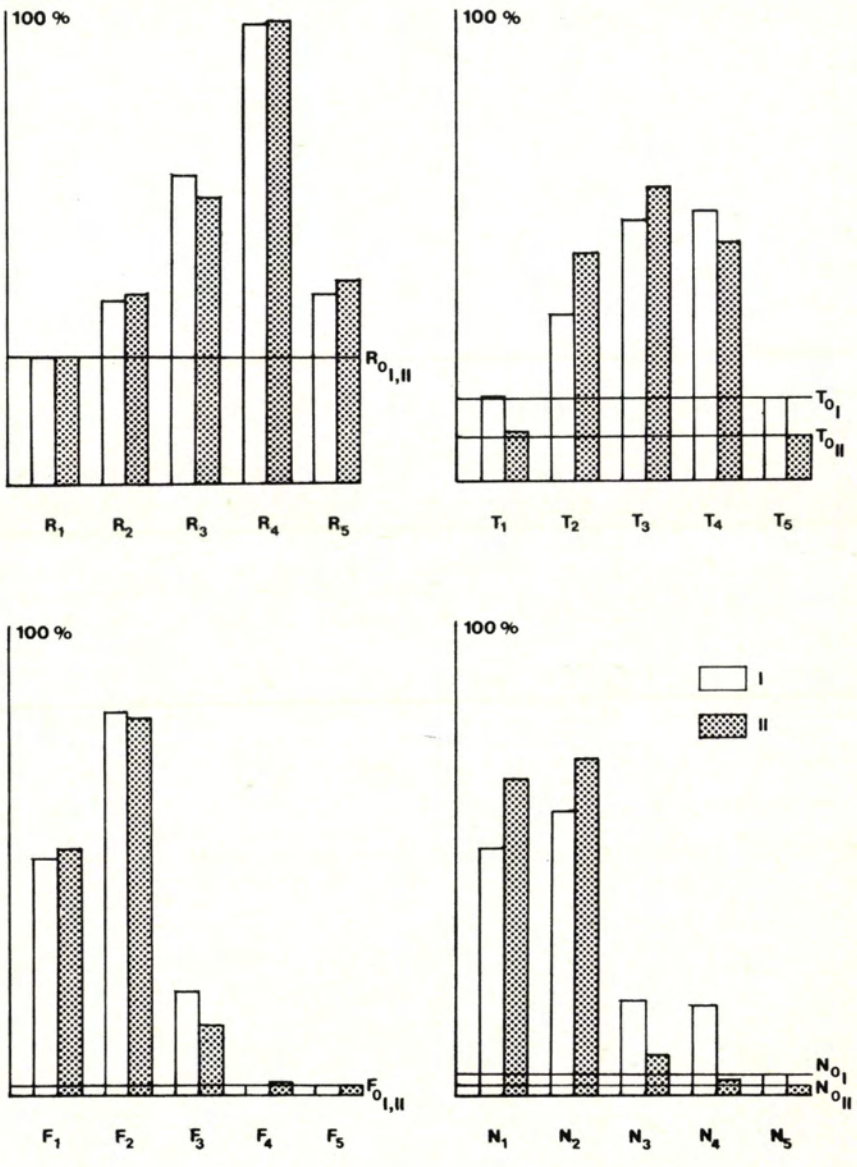


Fig. 2 Distribution of the R, T, F, N values in the two sampled areas

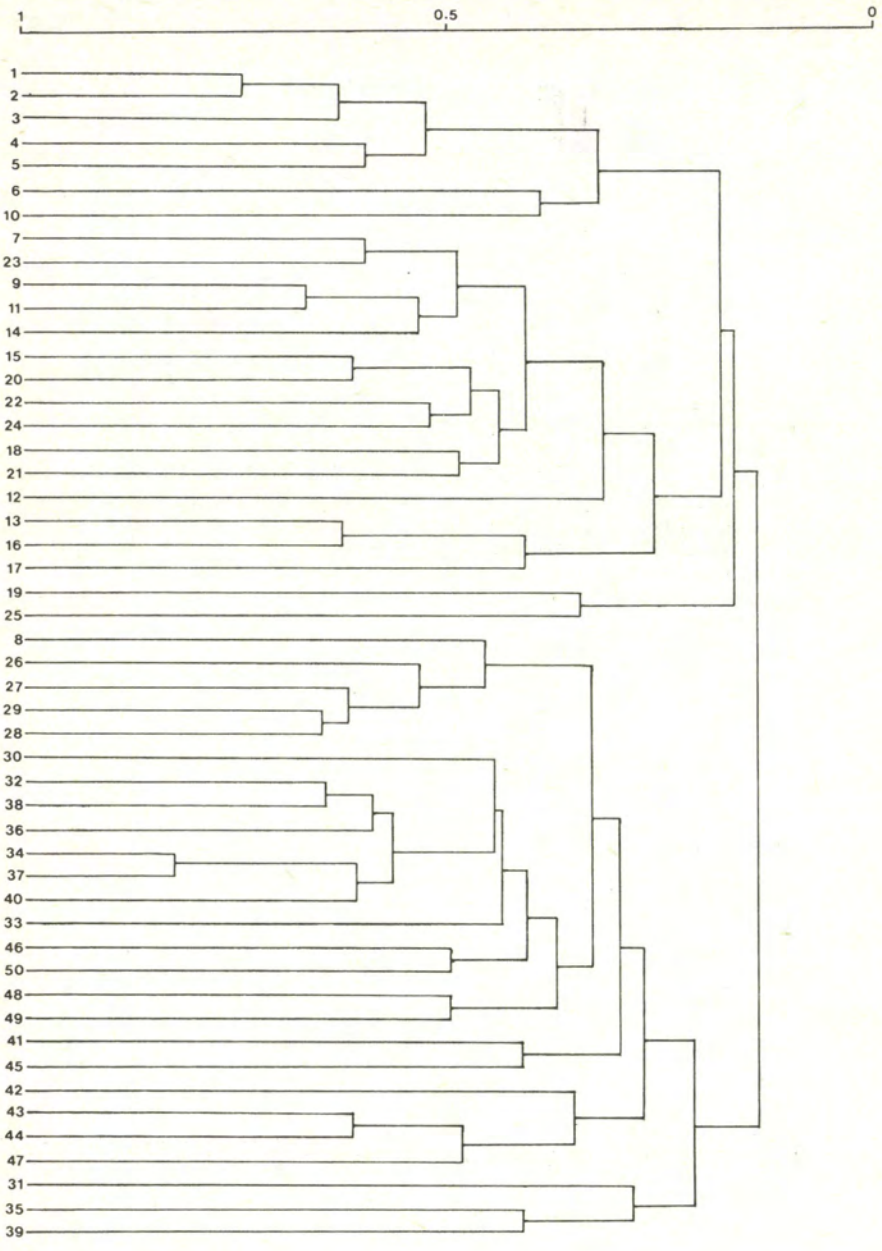


Fig. 3 Dendrogram of a matrix of CZEKANOWSKI's index of similarity

RESULTS

The phytogeographical spectrum shows that the number of cosmopolitan and adventive species is almost the same in both sites. There is no essential difference between the floral element groups.

From the point of view of cenological character site I is considerably the poorer of the two sites in Festuco-Brometea and Quercetea elements. Instead of these species indifferent elements and the members of weed associations appeared (e. g. Eryngium campestre, Sideritis montana, Chondrilla juncea, Fumaria schleicheri).

The life-form distribution unambiguously shows the dominance of therophyton and hemitherophyton species in site I. It can be seen in the disturbed grassland communities the proportion of geophyton, chamaephyton and hemikryptophyton species decreased and these spots are occupied by therophytons and hemitherophytons of great reproductive capacities. These species abundances are probably proportionate to the degree of degradation.

I also made attempts to examine other parameters as well. It can be seen in Fig. 2 that the R_0 values are high, indicating that several species have no special soil requirements. They occur in several grassland communities. There is no notable difference between the sites in this respect.

The high R_3 and R_4 values indicate the great number of basophilous species.

I could distinguish between the two sites from the point of view of temperature requirement. The number of species in common is low. This is shown by the small absolute value of T_{oII}. The large number of species of site II belongs to the groups of the normal and thermophilous species. The value T_{oI} indicates that many more different species occur in site I. ($T_{oI} \geqslant T_{oII}$). The most characteristic figure of all is the distribution of water requirements.

Water is the most important parameter in xerophilous communities like the ones studied, water limits the life processes, the species' range, etc. So the indifferent species are very few in both sites.

Comparing the two groups from the point of view of nitrogen requirement, they are obviously different from each other ($N_{oII} \leqslant N_{oI}$). There are less indifferent species in the "Öreg-szirt" site. Species of nitrophilous character occurred exclusively in site I, this character does not appear in site II.

Summarizing the differences of species composition of the two areas, therophytons and hemitherophytons partly take the place of the kryptophytons and hemikryptophytons because of erosion, disturbed grass surface (treading of the grass), and the overcrowded stock of game. Generally the species composition becomes poor and patches consisting of few species appear in the communities (Bromus squarrosus, Agropyron repens). Some are observed in the Pilis Mountains where the degree of degradation is so high that the plant cover consisted of only therophytons of short life-cycle. In site I I observed the expansion of Agropyron repens, A. intermedium, Arenaria serpyllifolia, Bromus squarrosus and Centaurea micranthos.

According to microclimate measurements (HORÁNSZKY 1964), the appearance of the above-mentioned grass species changes the temperature conditions above the soil surface at 30 cm height. So in the grass patches the originally observed extreme temperature fluctuations decrease. The changed microclimate provides an opportunity for the establishment and expansion of other therophyton species which avoid temperature fluctuations. So in some degraded patches (near site I) the succulent species completely disappeared (e. g. Sempervivum hirtum, S. marmoreum, Sedum spp.).

In Fig. 3 we can see the dendrogram of a cluster analysis of a matrix of CZEKANOWSKI's similarity index. Eight groups are obtained at 0. 3 similarity value. The first four clustered groups form the sample plots (24 quadrates) of the degraded area (Klastrom-szirtek). The other four groups comprise the sample plots (26 quadrates) of the control area (Öreg-szirt). Only one quadrate from site I was allocated to site II. The dendrogram clearly shows the separation between two areas.

Acknowledgements are due to Dr. M. RAJCZY for his advice on suitable methods for the computer analysis.

Table

Species and their cover values in sample plots

	Species	Samples I																				Samples II																													
		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	28	29	30	31	32	33	34	35	36	37	37	39	40	41	42	43	44	45	46	47	48	49	50
A	Cerasus mahaleb (L.) Mill.																							+																											
	Fraxinus ornus L.				+								4							4					2	+																									
	Quercus pubescens Willd.																																			1															
C	Bryophyta synusium																2					2																													
	Achillea pannonica Scheele						+						2					1																						1	2										
	Agropyron intermedium (Host.) P. B.																																										3								
	Agropyron repens (L.) P.B.	1	+		+	+		1		2	1						1	3	2			2	2	2	2	2										5				5	1										+
	Allium flavum L.						+	2	2	1	1	2			+	1					+	+	+		+		+			1	+		+	3	+				+		+	+		+					+		
	Allium montanum F. W. Schmidt													+		+					+						2	+	1	2	1	3	4		3	2	2	3	2	2	3	2					2	+			
	Allium scorodoprasum L.	+				+																																													
	Alyssum montanum L.							2	2	2		2	1	2	2	+	1	2			1		2	2																											
	Anthemis tinctoria L.											+		+			+				1				1																						+		+		+
	Anthericum liliago L.																																2	1																	
	Anthericum ramosum L.																														1	1								+							+				
	Arenaria serpyllifolia L.	2	2	2			1	1				1											2				+	+														+									
	Artemisia campestris L.																											+												+	+		+	+	1			1			
	Asperula cynanchica L.	+		+	+	+									+																											1	1	1	1	1		+		1	+
	Asplenium ruta-muraria L.																				+	+										+	+					+				+									
	Asplenium trichomanes L.																							+																											
	Aster linosyris (L.) Bernh.																																														2	1			
	Brachypodium pinnatum (L.) P. B.																															3																			
	Bromus squarrosus L.												+	+			2	2																																	
	Bupleurum falcatum L.																	+	+	+			+	+												+															
	Calamintha acinos Clairv.	+	1			+								+									+	+	+		+				+														+		+				+
	Campanula rotundifolia L.																																							+			+	+				1			
	Cardaminopsis arenosa (L.) Hay																																		+																
	Centaurea sadleriana Janka																															3	1		+																
	Centaurea micranthos S. G. Gmel.				2			1	+	+					1		1			+				+															+							1					
	Cerastium pumilum Curt.																																																+		
	Cerasus mahaleb (L.) Mill.	+								2	1	+																																							

Table (cont. 1)

Species	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	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Cleistogenes serotina (L.) Keng																																																	1	
Clematis vitalba L.																							+																											
Chondrilla juncea L.											+					+		+																		1														
Consolida regalis S. F. Gray																																																	+	
Cuscuta epithymum (L.) Nath.																						+																												
Cynodon dactylon (L.) Pers.																																																2	2	
Cynoglossum officinale L.		+				2				+		1	2	2	+	2		2		2	+	1	1	2	2																								
Dactylis glomerata L.												+																																						
Dianthus pontederae Kern.																												+			+								+				+	+		+			
Eryngium campestre L.																	2							+																		+			+					
Erysimum sp.						1																																											
Euphorbia cyparissias L.	1	+					1			1		1			+			2	2		+	+	+	+	2					+			+									+	1		+		1		2
Festuca valesiaca Schluck ex Gaud.							2	2					1		1	2						1				2	3	3	2	4	2	3	3	3	+	4	4	4	2	4		1	1		2	2	2	2	2
Fragaria vesca L.																																																+
Fraxinus ornus L.									+													2											1																
Fumaria schleicheri Soy.-Vill.	+	1	+	+	+	1																																										
Galium aparine L.	+																																															
Galium verum L.							1		+	1	1	1						2					+						+			2																
Geranium sanguineum I.																												1																				
Helianthemum nummularium (L.) Mill.																																												+	1	1		2		
Hieracium pilosella L.																		+																															
Hypericum perforatum L.																				+					+							+								+							
Inula ensifolia L.																																						1			1							
Inula oculus-christi L.														2																																			
Iris pumila L.														+							+	1								3				1													
Iris variegata L.			2																																													
Koeleria cristata (L.) Pers.	+		2	1	1		2												+							2	3	3	3										2			+						
Lactuca perennis L.		+		1	+	2			+																										+				+			+				+		
Linaria angustissima (Lois.) Borb.																																											1				+		
Linaria genistifolia (L.) Mill.																								+										+													+	
Medicago prostrata Jacq.												+																																				
Melandrium album (Mill.) Garcke					+	2						2																																				
Melica ciliata L.							2	+	2		2	2	2	2	2	1		2		2	3	2	2	2																									
Muscari comosum (L.) Mill.		+																		+				+																								
Myosotis stricta Link in R. et Sch.	+	+	+	+	+																																											

Table (cont. 2)

Species	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	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Odontites rubra (Baumg.) Opiz																														+												+					1		
Orobanche sp.																																																	+
Oryzopsis virescens (Trin.) Beck																					1				2																								
Papaver dubium L.	+	+																				+																	+									
Phleum phleoides (L.) Karsten									+	2	2	+	1	1		1																																	
Poa bulbosa L.																											+																					
Polygonatum odoratum (Mill.) Druce	+	+	+	+	+	1				+																																					
Potentilla arenaria Borkh.																																1	1	2		1	2	1	1	1	2		1,		+	2	1		2
Prunus spinosa L.																																															1		
Quercus pubescens Willd.																																														1		
Rosa sp.	+																																															
Salvia pratensis L.					2							3											2			+																2							+
Sanguisorba minor Scop.							+		2		2		1	2	2	1		1		1	2	2	+	1	+	2			+	+	1	1	2					1		1	2	2	2	2	1		1	2	2
Scabiosa ochroleuca L.																															2				1		+						1	+	1		+			
Scorzonera austriaca Willd.						+																				+																						
Sedum acre L.											2		2		1	2	2																			+				+								
Sedum album L.	+	+	+	+	1	3		2	2	2	2	1	2		2	2							+				+	1		1	+	+		1	1	1		1		2	1			1	2			
Sedum maximum (L.) Hoffm.																																																
Sedum sexangulare L.						1	2													+			2		+		+		1				+							2			+				
Sempervivum hirtum Jusl.	+		+			+	2	+	2	2	2	2		2								+	1					+	+				+	+	+			+	+		+			+	+			+
Sempervivum marmoreum Gris.																										1										+												
Seseli osseum Cr.			+	+			1	1		2	1	+			1			1	1	1	1	1				2	2	+	1	2	+	1	+	2	+	1	2	2		1	2	2		2	2	1	1	2	2
Sideritis montana L.														+																																	
Sorbus aria (L.) Cr.																		+																														
Sorbus torminalis (L.) Cr.																		1																														
Stachys recta L.			+	1	2	2	1		1	2	1	1		+	1	2				2		+	1	1		+							+							1	+	1		+	1			1		+
Stipa capillata L.																				2		+																							1				
Teucrium chamaedrys L.	2	2	2		2	1				2									3			2		2											+					2		1	+					
Teucrium montanum L.																																											1	1						
Thesium linophyllon L.																																1																	
Thymus glabrescens Willd.	2	2	2	1	1									2	2			1		2	+	+	+						+			1		+			+			1		+	+		1	1		+	
Thymus marschallianus Willd.																																											+	+		1				1
Verbascum sp.																																									+								
Veronica spicata L.																											+	1	1	2		2								+	+								
Vinca herbacea W. et K.																																															+		
Viola arvensis Murr.	1	1	+	+	+																																												
Viola odorata L.																			2		1				1																								
Viola sp.											+																																						
Xeranthemum annuum L.																	2	2			2																												

REFERENCES

BRAUN-BLANQUET, J. (1964): Pflanzensociologie. - Wien-New York, 865 pp.

HORÁNSZKY, A. (1964): Die Wälder des Szentendre-Visegráder Gebirges. - Akadémiai Kiadó, Budapest, 286 pp.

MAAREL, E. van der (1979): Transformation of cover-abundance values in phytosociology and its effects on community similarity. - Vegetatio 39 (2): 97-114.

MÁTHÉ, I. (1956): Vegetációtanulmányok a Nógrádi Flórajárás területén. [Vegetation studies in the area of the Nógrád flora district]. - MTA Agrártudományok Osztályának Közleményei, 9: 1-56.

POLGÁR, S. (1933): A bakonyi Tobánhegy vegetációja. [Vegetation of the Tobánhegy in the Bakony Mountains]. - Bot. Közlem. 30: 32-43.

PRISZTER, SZ. (1985): Synopsis systematico-geobotanica florae vegetationisque Hungariae VII. - Akadémiai Kiadó, Budapest, 683 pp.

SOÓ, R. (1930): A modern növényföldrajz problémái, irányai és irodalma. [Problems, directions and references of the modern geobotany]. - A Magyar Biológiai Kutató Intézet Munkái, 3: 1-37.

SOÓ, R. (1964-1980): Synopsis systematico-geobotanica florae vegetationisque Hungariae I-VI. - Akadémiai Kiadó, Budapest, (1964): 519 pp., (1966): 655 pp., (1968): 506 pp., (1970): 614 pp., (1973): 723 pp., (1980): 556 pp.

ZÓLYOMI, B. (1958): Budapest és környékének természetes növénytakarója. [Natural vegetation of Budapest and its surroundings]. In: Budapest természeti képe. [Natural aspect of Budapest], ed. Pécsi, M. - Akadémiai Kiadó, Budapest, 744 pp.

Author's address: T. SZERDAHELYI
Botanical Department of the
Hungarian Natural History Museum
Budapest, Pf. 222
H-1476
HUNGARY