

CONTRIBUTION TO THE ECOLOGY OF THE STEPPE VEGETATION OF THE TIHANY PENINSULA

I. DESCRIPTION OF THE SAMPLE AREA AND OF THE PLANT COENOSIS ANALYSED

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According to objectives, our ecological experimental research work in 1962 was conducted in the rock swards of the "Kiserdő" sample area of Tihany. In the following a brief survey is given of the sample area, of the coenological structure and biotope conditions of the plant society studied.

In the geological structure of the Tihany peninsula three formations are involved. The basis of the peninsula consists of Upper-Pannonian sand and pumice on which the produce of the Lower Pleistocene volcanism the basalt tuff is settled. Basalt tuff spreading was followed by post volcanic action the siliceous carbonatic products of which are the geysirites. The above described stratigraphic series is found on the N shore of the pond Belső-tó (Inner Lake) on *Kiserdőtető*. The Upper-Pannonian sand and pumice can be found above the narrow Holocene foreshore of Belső-tó up to a height of 150 m above sea level. On this is settled the basalt tuff which can be readily observed on the northern side of the Kiserdő-tető hill. On the ridge can be found the post volcanic formations, the geysirites.

The denudated detritus of basalt tuff and geysirite reach down to the foot of the hill and in most cases cover the Pannonian sand and sandstone. On one of the hilly extensions to the south near the village in a height of about 150 m sporadically pleistocene river gravel is found.

The soil of the sample area has developed on the ground rock characterized in detail, with a 40—50 cm deep surface soil, its pH value ranging from 7 to 7.8. In the upper 10 cm horizon the humus content is high (6—7 per cent), in some places with a high (10—20 per cent) CaCO₃ content. To characterize the soil of the sample area the data of the following sample profile are presented:

Depth cm	H ₂ O	pH KCl	CaCO ₃	Sticky point accord- ing to Arany	Humus %	mg/100 g					Capillar water elevation		
						HCO ₃ ⁻	Cl ⁻	SO ₄ ^{- -}	Ca ⁺	Mg ⁺	5 h	20 h	100 h
0—12	7.2	6.8	—	30	6.7	58.5	6.1	44.2	16.9	4.6	13	20	28
12—32	7.6	6.8	8.99	28.5	2.9	58.5	5.8	40.3	13.4	4.5	11	23.5	47
32—46	7.8	6.9	22.7	22.5	1.6	43.9	7.7	40.3	11.2	5.5	18	31.5	57.5

On the temperature of the year 1962 it can be stated that it was by some degrees (1.5—2.0 °C) cooler in the monthly average than the values of many

(10) years, except for the months of January, April, August and October the monthly mean value of which was 0.5 to 1.5 °C higher than the average (*Fig. 1a*).

The year can be generally regarded as poor in precipitation, particularly when considering end of the spring (April 19 mm, May 13 mm) and beginning of summer (June 47.9 mm less) so important for experimental ecological research. In the period of our examinations rainy days followed, which has raised the sum of the precipitation of the month of July by about 30 mm above the 10 year average (*Fig. 1b*).

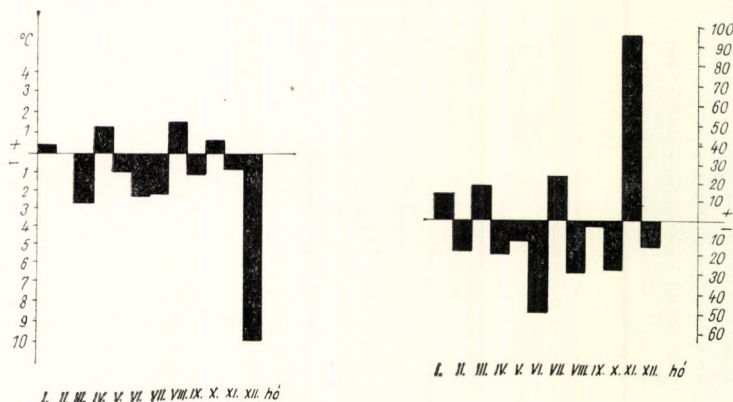


Fig. 1. Deviation of mean temperature (1a) and sum of precipitation (1b) from the ten year (1951—1960) average.

1. ábra. 1962 évi középhőmérséklet (1a) és csapadék összeg (1b) eltérése a 10 évi (1951—1960) átlagtól

A picture more illustrative from the point of view of our investigations than the monthly average is offered by the daily developments of temperature (diurnal maximum—minimum) and precipitation conditions on which data are presented in *Fig. 2*.

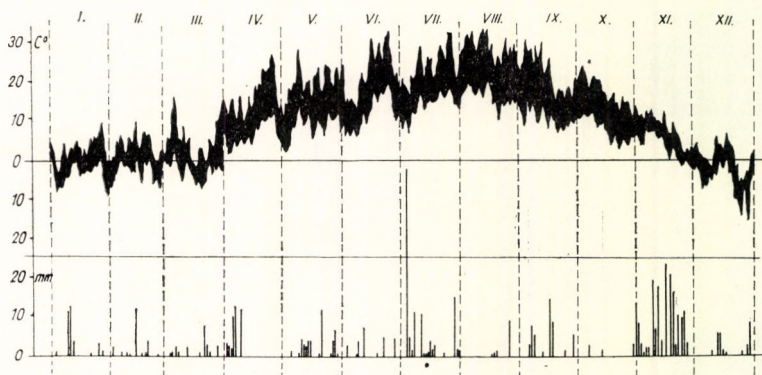


Fig. 2. Change of the diurnal maximum-minimum values of temperature and sum of precipitation. (On the strength of the data of the meteorological station of the Biological Research Institute of the Hungarian Academy of Sciences, 1962.)

2. ábra. A hőmérséklet napi maximum-minimum értékeinek változása és a csapadékösszeg (Tihany. MTA. Biológiai Kutatóintézet meteorológiai állomása adatai alapján. 1962).

On the coenological and ecological conditions of the rock swards of the Tihany peninsula information is contained in the ecological and coenological studies of R. Soó about the environments of Lake Balaton (Soó R. 1959).

Our own synecological, experimental-ecological and physiological investigations were conducted in the stands of *Stipetum stenophyllae pannonicum*. The material of the physiological laboratory examination (on the results of research work we report in the wake of the work of M. RYCHNOVSKA and J. KVET in the following chapters II., III.) also derives from there. The stands occupy spots of greater extent among the zonal *Cotinetum-Quercetum pubescentis balatonicum* of submediterranean character developed by natural afforestation. In this area beautiful stands have developed, *Stipeta stenophyllae* of secondary character, in all probability in the place of abandoned garden cultures and vineyards. The stands of the association on Kiserdőtető have a coverage of 97–100 per cent. An important part is played by the association and alliance (Verband) character species. (Alliance participation: 28 per cent.) With the same percentage are involved the *Festucetalia valesiaca* elements (alliance participation: 31 per cent). *Festuca-Brometea* species occur with 20 per cent. Also the participation of *Quercetea pubescentis* and *Querco-Fagetea* elements is important.

Chenopodietalia elements have a slight significance. For the characterization of the coenological structure of the association the following survey is offered:

	Alliance participation — Csoport részesedés, %	Alliance mass — Csoport tömeg, %
<i>Stipetum stenophyllae</i> species	9.60	2.25
<i>Festucion sulcatae</i> species	18.84	22.52
<i>Festucetalia valesiaca</i> spec.	31.91	21.62
<i>Festuco-Brometea</i> species	19.07	29.28
<i>Quercetea pubescentis</i> spec.	13.18	6.31
<i>Quercetalia—Querco-Fagetea</i> species	5.85	7.66
<i>Secalinetea-Chenopodietea</i> species . . .	0.12	2.70
Other accompanying species	1.42	7.66

The constant (KV) and subconstant (KIV) species of the association: *Stipa stenophylla*, *Orlaya grandiflora*, *Stipa pulcherrima*, *Thymus marschallianus*, *Vinca herbacea*, *Convolvulus cantabricus*, *Agropyron intermedium*, *Centaurea micranthos*, *Festuca valesiaca*, *Allium flavum*, *Hieracium bauchini*, *Potentilla arenaria*, *Pulsatilla grandis*, *Silene otites* var. *pseudotites*, *Asperula cynanchica*, *Phleum pheloides*, *Salvia nemorosa*, *Eryngium campestre*, *Medicago falcata*, *Melica ciliata*, *Plantago media*, *Stachys recta*, *Teucrium chamaedrys*, *Bupleurum falcatum*, *Coronilla coronata*, *Cytisus austriacus*, *Achillea millefolium* sp. *collina*, *Hypericum perforatum*.

Among the *Stipetum stenophyllae* stands surveyed on the sample area of Tihany—Kiserdőtető and the other stands of the Hungarian central range of mountains the following differential species can be demonstrated: (Comparison on the grounds of Z. BARÁTH's study).

When comparing the stands of *Stipetum stenophyllae* collected in the Kiserdő sample area of Tihany with the other stands of the Hungarian central

Table — Táblázat

		No. of survey	1	2	3	4	5	A—D	K
		Altitude above sea level	98	98	100	100	97		
		Grade of coverage in the grass horizon	—	15	15	—	20		
		Ibid. in the moss horizon	NO	NO	NO	O	SO		
		Exposition	2°	5°	3°	5°	5°		
		Slope angle							
<i>Stipetum stenophyllae species</i>									
Kt	H	<i>Stipa stenophylla</i>	2—3	+—1	1	1	2	+—3	V
<i>Festucion sulcatae species</i>									
Em—Subm	Th	<i>B. Orlaya grandiflora</i>	+	+	+	+	+	+	V
Eua—Kt	H	<i>Stipa pulcherrima</i>	1	2	1—2	2	1—2	1—2	V
Kt—Eua	Ch	<i>Thymus marschallianus</i>	1	1—2	1	1	1—2	1—2	V
P—Pann	H	<i>Vinca herbacea</i>	+—1	+	(+)	1	+—1	+—1	V
Subm	H	<i>B. Convolvulus cantabricus</i>	+	+	—	+	(+)	+	IV
Eua—Kt	TH—H	<i>Erysimum diffusum</i>	+	—	+	+	—	+	III
Eua—Kt	H	<i>Adonis vernalis</i>	+(1)	—	—	+—1	—	+—1	II
Subm—Kt	H	<i>Astragalus onobrychis</i>	(+)	2	—	—	—	+—2	II
Eua—Subm	H	<i>B. Crysopogon gryllus</i>	(+—1)	(+)	—	—	—	+—1	II
Eua—Subm	Th	<i>Crupina vulgaris</i>	—	+	+—1	—	—	+—1	II
P—Pann	Th	<i>Inula oculus-cristi</i>	—	+	—	+—1	+—1	+—1	II
Pann—Balk	H	<i>Jurinea mollis</i>	—	+	—	1	—	+—1	II
P	G	<i>Iris pumila</i>	—	—	—	+	(+)	+	II
P	H	<i>Linum austriacum</i>	—	—	+	+	—	+	II
Eua—Kt	H	<i>Stipa pennata</i>	+	—	—	—	+	+	II
Kt Ena	H	<i>Verbascum phoeniceum</i>	—	—	+	(+)	—	+	II
P—Subm	?h	<i>Xeranthemum annuum</i>	+	—	—	—	(+)	+	II
Accidental (only in 1—2 surveys)									
Kt	H	<i>Achillea millefolium ssp. pannonica</i> (3.: +)							
<i>Festucetalia valesiaca species</i>									
Eua	G	<i>Agropyron intermedium</i>	1	1	1	1	1	1	V
Eua	TH—H	<i>Centaurea micranthos</i>	+	+	+	+	+	+	V
Em	H	<i>Festuca valesiaca</i>	1—2	2	1—2	1—2	2—3	1—3	V
Subm	G	<i>Allium flavum</i>	2	(+)	—	1—2	1—2	+—2	IV
Eua—Kt	H	<i>Hieracium bauchini</i>	+	+	+—1	+—1	—	+—1	IV
Eua—Kt	H	<i>Potentilla arenaria</i>	1—2	1—2(3)	—	1(2)	1—2	1—3	IV
Pann—Balk	H	<i>Pulsatilla grandis</i>	1(2)	1	1	—	1—2	1—2	IV
Eua—Kt	H	<i>Silene otites var. pseudotites</i>	+	+	—	+	+	+	IV

Eua—Kt	H	Scabiosa ochroleuca	+	—	—	+	+	+	III
Eua	H	Stipa capillata	—	+(1)	1-2	+—1	—	+—2	III
Eua	H	Veronica spicata	+	+	—	—	+	+	III
P—Pann	H	Anthyllis polyphylla	+	—	—	+—1	—	+—1	II

Accidental:

P—Subm Th—H Nonea pulla (4.:+), PH Onosma arenaria (4.:+)

Festuco-Brometea

Subm—Em	H	Asperula cynanchica	1-2	1	1	1-2	1-2	1-2	V
Eua	H	Phleum phleoides	+—1	1	1	(+)	1	+—1	V
Eua—Kt	H	Salvia nemorosa	+—1	+—1	+—1	+	+—1	+—1	V
P—Subm	H	Eryngium campestre	+	+	+—1	—	+	+—1	IV
Eua	H	Medicago falcata	+—1	1	—	+	+	+—1	IV
P—Subm	H	Melica ciliata	+	+	+	+	—	+	IV
Eua	H	Plantago media	1	+	—	+	+	+—1	IV
P—Subm	H	Stachys recta	+—1	1	+—1	—	+—1	+—1	IV
Eua	H	Filipendula vulgaris	1	—	—	1(2)	+—1	+—2	III
Eua—Kt	H	Galium verum	1	—	—	+	+	+—1	III
Subm—Em	Ch—H	Helianthemum ovatum	+	2	—	+	—	+—2	III
Cp	H	Koeleria cristata	—	—	1	+	1	+—1	III
Eua—Subm	H	Pimpinella saxifraga	(1)	+—1	—	—	+	+—1	III
Eua	H	Plantago lanceolata	—	—	+	1	+	+—1	III
Eua—Kt	H	B. Sanguisorba minor	1	+—1	—	—	+	+—1	III
Em—Subm	Ch	Sedum sexangulare	+	—	—	+	+—1	+—1	III
Eua—Kt	H	Poa bulbosa	—	—	—	(+)	+—1	+—1	II

Accidental:

Andropogon ischaemum (4.: +), Eua—Subm H Centaurea scabiosa (1.: +), Eua TH Falcaria vulgaris (1.: +), Eu H Potentilla recta (5.: +)

Quercetea pubescentis

Subm—Em	Ch	Teucrium chamaedrys	1-2	2(3)	1-2	1-2	2	1-3	V
Eua—Kt	H	Bupleurum falcatum	+	+	+—1	+—1	—	+—1	IV

Accidental:

Eua H Fragaria vesca (4.: 1), Eua—Kt Th Melampyrum cristatum (3.: 1), Eua H Bromus inermis (2.: +), Kt H Campanula boloniensis (4.: +), Eua M Crataegus monogyna (4.: (+))

Table — Táblázat folytatása

No. of survey			1	2	3	4	5	A—D	K
Altitude above sea level			98	98	100	100	97		
Grade of coverage in the grass horizon			—	15	15	—	20		
Ibid. in the moss horizon			NO	NO	NO	O	SO		
Exposition			2°	5°	3°	5°	5°		
Slope angle									
<i>Quercetalia—Quercus-Fagetea species</i>									
Subm	H	Coronilla coronata	1	(+)	1—2	1—2	+	+—2	V
P	M	Cytisus austriacus	+	+—1	1—2	—	1	+—1	IV
Em—Subm	H	Crysanthemum corymbosum	+	—	—	+	—	+	II
Em	H	Coronilla varia	—	(+)	—	+—1	—	+—1	II
P—Subm	M	Rosa gallica	(+—1)	—	—	—	1	+—1	II
Eu	H	Trifolium alpestre	(+—1)	(+)	—	—	—	+—1	II
<i>Secalinetea-Chenopodietea species</i>									
Eua—Subm	TH	Echium vulgare	—	—	+	(+)	—	+	II
Eua—Kt	H	Euphorbia virgata	—	+	+	—	—	+	II
Accidental:									
Eua	TH	Melilotus officinalis (3.: +),							
Eu—Subm	Th—TH—H	Reseda lutea (2.: +)							
<i>Accompanying species</i>									
Eua—Kt	H	Achillea millefolium ssp. collina	1	(+)	+	+—1	+	+—1	V
Eua	H	Hypericum perforatum	+	(+)	+	+—1	+	+—1	V
P—Med	M	Cotinus coggygria	(+)	—	+	—	—	+	II
Eua	H	Euphorbia cyparissias	—	+	—	+—1	—	+—1	II
Subm	MM	Fraxinus ornus	—	(+)	(+)	—	—	(+)	II
Accidental:									
Eua—Subm	H	Dactylis glomerata (3.: (+))							
Place of survey:									
1—5 Tihany: Kis-erdő 15—16. VII. 1962.									

	I	I	III	IV	V	VI	VII	VIII	IX	X	XI	XII
<i>Tihany 1962.</i>												
Temperature, °C	0.4	0.6	2.4	12.6	15.2	17.8	19.9	23.0	16.4	12.3	5.2	-7.5
Precipitation/mm	42.9	20.2	47.5	15.4	42.2	22.1	101.3	9.7	39.4	17.4	145.9	27.8
1951—1960 mean values of 10 years												
Temperature, °C	0.0	0.6	5.1	11.3	16.1	20.1	21.9	21.5	17.6	11.9	6.1	2.6
Precipitation/mm	28	38	26	34	54	71	77	39	41	45	50	43

range of mountains and in knowledge of the results and opinion of Z. BARÁTH the following differential species can be demonstrated:

The presence of certain species: (*Orlaya grandiflora*, *Vinca herbacea*, *Convolvulus cantabricus*, *Crysopegon gryllus*, *Linum austriacum*, *Stipa pennata*, *Achillea millefolium* ssp. *pannonica*, *Silene otites* var. *pseudotites*, *Nonea pulla*, *Poa bulbosa*, *Bupleurum falcatum*, *Fragaria vesca*, *Bromus inermis*, *Campanula boniniensis*, *Coronilla coronata*, *Euphorbia virgata*, *Reseda lutea*, *Achillea millefolium* ssp. *collina*, the absence of others) i.e. the difference of A—D and K values in the common species made it possible to differentiate the *Stipetum stenophyllae pannonicum* stands from Tihany from the until now published other stands of the Hungarian central range of mountains (BARÁTH Z. 1964).

Differential species: *Bupleurum falcatum*, *Chrysopogon gryllus*, *Convolvulus cantabricus*, *Coronilla coronata*, *Orlaya grandiflora* and *Vinca herbacea*.

The higher participation of the submontane elements also demonstrates their percentual presence in the inland *Stipetum stenophyllae* stands increases in the central mountain range from NE towards SW.

Furthermore it is a conspicuous difference that while towards NE the number of forest-steppe species i.e. of Quercetea species increases, in the investigated area the Festucion, i.e. Festucetalian elements dominate percentually in higher rates.

According to these facts it seems necessary and reasonable to differentiate the stands collected in Tihany and its surroundings as they represent a subassociation separable also geographically. On the hand of the typical presence and of the comparatively high A—D and K values showing *Coronilla coronata* in it we nominated it: *Stipetum stenophyllae pannonicum coronilla-tosum coronatae*.

Analysing the flora element conditions of the association it can be established that in these the submediterranean (abt. 20 per cent) and the Eurasian elements (abt. 20 per cent) are dominating.

To demonstrate the flora element distribution of the association the following survey is offered:

	Alliance participation — Csoport részesedés, %	Alliance mass — Csoport tömeg, %
Kt	9.65	3.15
Kt—Eua	3.78	3.15
P	1.94	4.06
P—Pann	1.84	4.06
Pann—Balk	3.76	2.70
P—Subm	2.33	8.56
Subm	8.20	6.76
Subm—Em	19.10	5.86
Subm—Kt	3.15	0.90
Em	11.86	3.15
Em—Subm	0.42	4.50
Eu	0.25	1.35
Eu—Subm	0.02	0.45
Eua	10.97	21.63
Eua—Kt	20.40	23.42
Eua—Subm	1.27	4.95
Cp	1.06	1.35

In the structure of the association the hemikryptophyte species dominate but a significant part is played by the chamaephytes and geophytes elements (alliance participation: 8 per cent). The participation of the species belonging to the other life ranges from 1 to 2 per cent. The alliance — participation of trees and shrubs intruding from the *Cotinetum-Quercetum pubescentis balatonicum* surrounding the *Stipetum stenophyllae* is about 3 per cent. To present the life form conditions of the association the following survey is published:

	Alliance participation — Csoport részesedés, %	Alliance mass — Csoport tömeg %
MM	0.04	0.90
M	2.65	4.06
Ch	15.60	5.86
Ch—H	3.17	1.35
H	68.95	71.17
G	8.00	4.95
TH—H	0.16	3.60
TH	0.08	1.80
Th—H	0.02	0.45
Th—TH—H	0.02	0.45
Th	1.31	5.41

Stipetum stenophyllae pannonicum is followed in the course of succession by *Cotino-Quercetum pubescentis balatonicum* and subsequently by *Orneto-Lithospermeto Quercetum pubescenti-cerris*. On the habitat described above the succession of the association can be only followed until *Cotinetum-Quercetum pubescentis*.

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ADATOK A TIHANYI-FÉLSZIGET SZTYEPEVEGETÁCIÓJA ÖKOLÓGIAI VISZONYAIHOZ

Összefoglalás

I. A mintavételi helyek és az analizált növényi cenózisok leírása.

Kárpáti István és Kárpáti Vera

Szerzők 1962. évi Kísérleti Ökológiai kutatásaik keretében cönológiai felvételezéseket végeztek a Tihany "Kiserdei" mintaterület *Stipetum stenophyllae pannonicum* gyepeiben. A felvételezett állományokat a hazai középhegység egyéb állományaival összehasonlítva és BARÁTH kutatási eredményeinek és véleményének figyelembe vételével a következőket állapították meg:

Bizonyos fajok jelenléte: (*Orlaya grandiflora*, *Vinca herbacea*, *Convolvulus cantabricus*, *Crypsogon gryllus*, *Linum austriacum*, *Stipa pennata*, *Achillea millefolium* ssp. *pannonica*, *Silene otites* var. *pseudotites*, *Nonea pulla*, *Poa bulbosa*, *Bupleurum falcatum*, *Fragaria vesca*, *Bromus inermis*, *Campanula bononiensis*, *Coronilla coronata*, *Euphorbia virgata*, *Reseda lutea*, *Achillea millefolium* ssp. *collina*, mások hiánya) illetőleg a közös fajok A—D és K értéke közötti különbség lehetővé teszi, hogy a tihanyi *Stipetum stenophyllae pannonicum* állományokat a Magyar Középhegység többi, eddig közölt (BARÁTH Z. 1964.) állományaitól elkülönítsük.

Differenciális fajok: *Bupleurum falcatum*, *Chrysopogon gryllus*, *Convolvulus cantabricus*, *Coronilla coronata*, *Orlaya grandiflora*, *Vinca herbacea*.

Mindezek alapján szükséges és indokolt a Tihany környékén felvett állományokat az eddig leirtaktól, mint geográfiailag is elkülöníthető subasociációt megkülönböztetni. A benne jellemzően előforduló és aránylag magas A—D és K értékű *Coronilla cornatária*: *Stipetum cum coronilletosum coronatee*-nek nevezzük.