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Distribution and diversity of Phleum alpinum L. and Phleum commutatum Gaud. (Poaceae) in the Carpathians

By

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Abstract: Author collected and mapped the distribution data of two taxa of Phleum in the Carpathians and analysed the distribution and diversity of specimens per taxa according to altitudes and natural habitats. Phleum alpinum L. is spreading to higher places, in alpine meadows and contrasted with this Ph. commutatum Gaud. is growing lower in altitude, in mountain grasslands and pine-woods. Author also dealt with taxonomical problems and tends to consider these two taxa as two independent species.

Introduction

The author has been dealing with Phleum for about five years (KOVÁTS 1967, 1977, 1980), investigated morphological and anatomical differences, natural habitats, distribution and diversity of Phleum hubbardii D.Kov. and Ph. pratense L.

In this paper the author should like to deal with the distribution and diversity of the two other taxa: Phleum alpinum L. and Ph. commutatum Gaud. touching the taxonomical problems too.

In connection with the plan of Central-European flora mapping we, as member of this international floristics group, collected and mapped data of flowering plants, mostly from our herbarium (SZUJKÓ-LACZA & SEN 1977, KOVÁTS & SZUJKÓ-LACZA 1979, KOVÁTS 1980).

Our herbaria (BP) are the most outstanding and complete ones in Hungary and significant even in Europe (SZUJKÓ-LACZA 1973). One of the collections is the Herbarium Carpato-Pannonicum, containing the flora of the Carpathian Basin, Great Hungarian Plain and the Carpathians (FEKETE & KOVÁTS 1974).

The common area and habitats of these taxa in question are mentioned in the Carpathians by JÁVORKA (1925), but the two taxa are mixed or not exactly separated. It was necessary to study every specimen in the herbarium, making a revision, because the identification sometimes is not easy and the sheets of the two taxa are mixed in the herbarium too.

The geographical distribution of these two taxa of Phleum in Europe and almost in the whole world are described by NORDENSKIÖLD (1945).

Material and methods

In the enumeration the localities of the collections appear in geographical order, following the curve of the Carpathians from west to east and south, beginning with North-West Carpathians and ending with the South Carpathians (BULLA & MENDÖL 1947). Following this the names of the

countries are written where these main parts of the Carpathian ranges are. They are followed by the names of the smaller parts of the Carpathians, mountians, villages, towns and counties, being corresponded to the used names at the time of collection. After this the detailed topography is written, if those can be found on the labels, followed by the collectors' names in shortened form and the data of collections. The data of collecting localities are mapped.

Herbarial labels of the sheets contain diverse information - sometimes those are very few - referring to the habitats and altitudes of localities, these are collected in two tables. These two groups of data are analysed by the SHANNON (1948) diversity index and by PIELOU (1975) evenness also.

Abbrevations of collectors' names

Andr.	= Andreánszky, G.	Lányi	= Lányi, B.
Barth	= Barth, J.	Le.	= Lengyel, G.
Bányai	= Bányai, J.	Mar.	= Margittai, A.
Borb.	= Borbás, V.	Márton	= Márton, J.
Bs.	= Boros, Á.	Moesz	= Moesz, G.
Cholnoky	= Cholnoky, B.	Moldvai	= Moldvai, R.
Czagl.	= Czaglady Nakó, G.	Pax	= Pax, F.
Czakó	= Czakó, K.	Páter	= Páter, B.
Csató	= Csató, J.	Per.	= Perlaky, G.
Csiki	= Csiki, E.	Pénzes	= Pénzes, A.
Cserni	= Cserni, B.	Pócs	= Pócs, T.
De.	= Degen, Á.	Richt.	= Richter, V.A.
Dorn.	= Dorner, J.	Scheffer	= Scheffer, J.
Feicht.	= Feichtinger, S.	Schermann	= Schermann, Sz.
Fil.	= Filarszky, M.	Schneider	= Schneider
Fodor	= Fodor, P.	Simk.	= Simkovics, L.
Hanák	= Hanák, J.	Simk.	= Simonkai, L.
Haynald	= Haynald, L.	Staub	= Staub, M.
Hazsl.	= Hazslinszky, F.	Szurák	= Szurák
Heuff.	= Heuffel, J.	Th.	= Thaisz, L.
Jáv.	= Jávorka, S.	Ti.	= Timkó
Ká.	= Kárpáti, Z.	Tr.	= Trautmann, R.
Kell.	= Keller, J.	Tuzs.	= Tuzson, J.
Ko.	= Kocsis, J.	V.	= Vajda, L.
K.	= Kováts, D.	Vág.	= Vágner, L.
Kup.	= Kupcok, S.	Vángel	= Vángel, J.
Kümm.	= Kümmerle, J.B.	Winkler	= Winkler, M.
Lackowits	= Lackowits	Zsák	= Zsák, Z.
Lándi	= Lándi, B.		

Abbreviations of towns (Maps 1-2)

B. = Bucureşti (Rumania)
BE. = Beograd (Yugoslavia)
BP. = Budapest (Hungary)
BR. = Braşov (Brassó, Rumania)
BT. = Bratislava (Pozsony, Czechoslovakia)

W. = Wien (Austria)
Z. = Zagreb (Zágráb, Yugoslavia)

Other abbreviations: Com. = Comitatus = County; Herb. = Herbarium

The old names of the smaller parts of the Carpathians, being found in the enumeration, corresponded to the time of collection and the equivalent, nowadays used names, according to the language of the country where the mountains are and according to the World Atlas (1967 ed. BARANOV).

Old names	New names
Nyugati Beszkidek	Mt. Slovenské Beskydy
Árvai Magura	Mt. Oravska Magura
Nagy-Fátra	Mt. Velka Fatra
Alacsony-Tátra	Mt. Nizke Tatry
Szepes-Gömöri Érchegység	Mt. Slovenske Rudohorie
Magas-Tátra	Mt. Visoke Tatry
Bélai Tátra	Mt. Belanske Tatry
Vihorlát	Mt. Vihorlat
Keleti Beszkidek	Mt. Beszczady
Máramarosi-havasok	Mt. Gorgany
Hoverla	Mt. Goverla
Gutin	Mt. Gutin
Pop Iván	Mt. Pop Ivan
Radnai-havasok	Mt. Rodnei
Nagy Pietrosz	Mt. Pietrosul
Kelemen-havasok	Mt. Calimani
Csiki-Havasok	Mt. Cincului
Hargita	Mt. Harghitei
Berecki-havasok	Mt. Vrancei
Brassói-havasok	Mt. Bucegi
Királykő	Mt. Piatra Crajului
Fogarasi-havasok	Mt. Fogarasului
Szebeni-havasok	Mt. Cindrelului
Pareng	Mt. Paringului
Retyezát	Mt. Retezatului
Szárkő	Mt. Tarcului
Bihar-hegység	Mt. Bihorului

Enumeration
Phleum alpinum L.
North-West Carpathians in Czechoslovakia

At Mts. "Nyugati Beszkidek": Sebestyénfalva (Com. Trencsén), Th. 23.08.1907.

At Mts. "Alacsony Tátra":"Chopok" (Com. Liptó), beyond Liptószentmiklós, Pax 08.08.1894 - "Kralova Hola", beyond Liptószentmiklós, Pax 09.08.1895.

At Mts. High Tatra: beyond Strba-obec, at Mt. "Krivan": Heuff., Herb. Haynald 07.1927. - Csorba (Com. Liptó), Per. 07-08.08.1907 - at valley "Furkota völgy", De. 11.08. 1904; Schermann 28.08.1923 - at valley "Mlynicka dolina", Pénzes 16.07.1958; Czagl. 1961; Moldvai 20.08.1963 - at valley "Mengusovská dolina" (Czechoslovakia), beyond Mengusovce, Le. 26.07.1928 - Menguszfalva, at Lake "Hincó-tó", Per. 07-08.08.1907 - at valley "Omladék völgy", Pax 22.08.1905 - Lake "Halas-tó", Lackowits 04.1883 - at valley "Felkai völgy" (Com. Szepes), beyond Gerlahfalva, I Schur, Kazsl. 1863; Schneider 28.08.1880; Czakó 20.07.1887 - at Lake "Velické pleso", K. 19.07.1976 - at Lake

"Hosszu tó", Hazsl. ? - at Lake "Kőpataki tó" beyond Tátralomnic, Fil. 30.07.1903 - Tatranské Matliary, at valley of river "Biela voda", Bs. 10.07.1933 - at Lake "Háromszög tó" beyond Poprád, Lányi 26.07.1907.

At Mts. "Bélai Tátra": Barlangliget (Com. Szepes), beyond Poprád, Borb. 07.1890.

North-East Carpathians in Soviet Union and Rumania

At Mts. "Keleti Beszkidek": beyond Munkács (Com. Bereg), Pax, 15.08.1894; Volocz, Th. 25.08. 1907; 26.08.1907.

At Mts. "Máramarosi havasok": Mt. "Hoverla" (Com. Máramaros), beyond Kőrösmező, Pax 22.08. 1894; Bs. 18.07.1934; 20.07.1939 - "Sighet" (Rumania), Ká. 24.07.1942.

At Mt. "Pop Iván" (Com. Máramaros): Vág. 07.1868; Pax 23.08.1894; Th. 30.08.1907; Mar. 19. 07.1938.

At Mt. "Gutin": beyond Máramarossziget (Com. Máramaros), Pax 17.08.1895.

At Mts. "Radnai havasok": at mountain "Ünökő" (Com. Beszterce-Naszód), De. 17.08.1902 - at mountain "Korongyis", near to Borsa, Andr. 11.07.1942 - beyond O-Radna, Pax 18.08.1903 - beyond Borsa (Com. Máramaros), at mountain "Nagy Pietrosz", Pax 14.08.1903 - beyond Borsabánya, Pax 13.08.1903 - beyond Cziblesfalva (Com. Beszterce-Naszód), Pax 11.08.1903.

East Carpathians in Rumania

At Mts. "Kelemen havasok": beyond Nagyilva (Rumania), Jáv. Kell. 14.07.1941.

At Mts. "Csiki havasok": beyond Gyergyószentmiklós (Com. Csik), at mountain "Nagy Hagymás", Pax 13.08.1896.

At. Mts. "Hargita": "Rákosi Hargita" (Com. Csik), near Madarasi Hargita and Csikrákos, Pax 15.08.1896 - at mountain "Harghita Oceului" (Rumania), near Miercurea-Cius, Pócs 16.08. 1955.

At Mts. "Berecki havasok": beyond Bereck (Com. Háromszék), Th. 30.06.1894.

South Carpathians in Rumania

At Mts. "Brassói havasok": Törcsvár (Com. Brassó), at Mt. "Bucsecs", De. 26.07.1902 - beyond Brassó, at mountin "Omu", Barth. 08.07.1885; Th. 28.06.1894; Pax 21.08.1896 - beyond Brassó, at mountain "Schuller", Pax 22.08.1909 - at Mt. "Piatra Máre", beyond Brassó, Pax 15.08.1912.

At Mts. "Királykő" (Com. Fogaras): beyond Zernest, Simk. 28.08.1883.

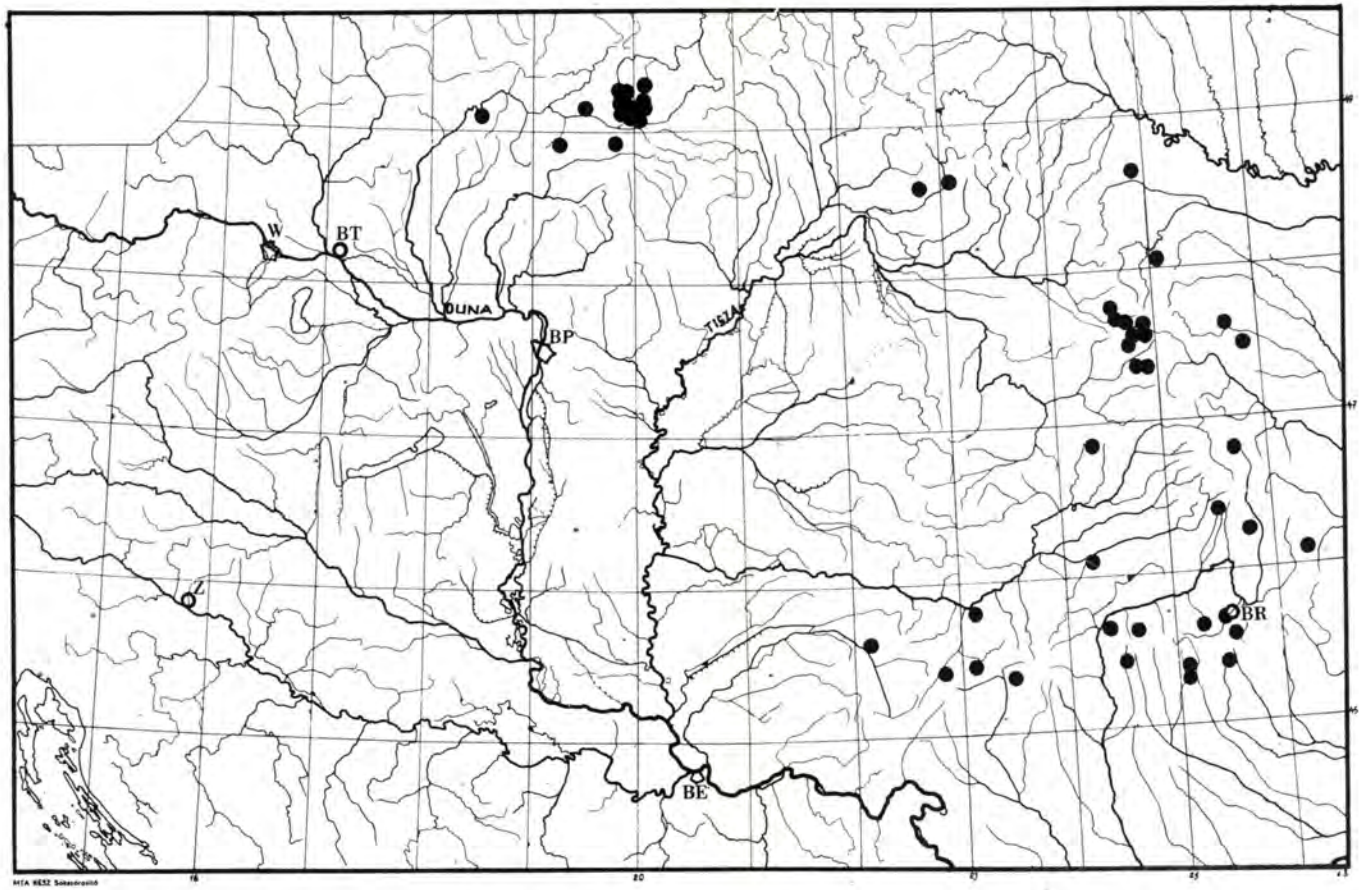
At Mts. "Fogarasi havasok": Kercisora (Com. Fogaras), Simk. 30.07.1872-12.08.1874; Pax 26. 08.1896 - at Mt. "Negoj" beyond Kercisora, ? 08.1844 - at Lake "Bilea tó", beyond Kercisora, Pax 14.08.1815.

At Mts. "Szebeni havasok": near Szász-Sebes (Com. Szeben), Pax 15.08.1897; 19.08.1897.

At Mts. "Pereng": beyond Petrozsény (Com. Hunyad), Pax 22.08.1897; 08.08.1902 - at mountain "Mundra", Pócs 30.07.1956.

At Mts. "Retyezát": (Com. Hunyad), Feicht. 31.07.1872; Le. 07.1906 - at Lake "Zenoga tó", beyond Petrozsény, Pax 12.08.1901 - beyond Szászváros, Jáv. 07.1904.

At Mts. "Szárkő": near Karánsebes (Com. Krassó-Szörény), Fodor 08.07.1915.



Map 1. Occurrence of Phleum alpinum L. in the Carpathians

Phleum commutatum GAUD.

North-West Carpathians in Czechoslovakia

At Mts. "Oravska Magura": beyond Zuberec (Czechoslovakia), Scheffer 17.07.1928.

At Mts. "Nagy Fátra": Körmöcbánya (Com. Bars) Jáv. 30.07.1907.

At Mts. "Alacsony Tátra": Fenyőháza (Com. Liptó), De. 17.07.1904 - beyond Zólyombreznó (Com. Zólyom), at mountain "Gyömbér", ? 17.07.1911 - at mountain "Királyhegy" (Com. Gömör), beyond Dobsina, Pax 07.08.1895; Práter 10.08.1901; Le 06.1910.

At Mts. "Szepes-Gömöri Érchegység": Krasna Horka (Czechoslovakia), Le. 07.1923; Helpa Rich. 08.07.1887 - Sajóréde (Com. Gömör), Kup., Tr. 04.07.1907; Kup., De. 05.07.1908 - beyond Rozsnyó, at mountain "Ökörhegy", Ká. 08.06.1939 - between Igló and Sztracena (Com. Szepes), Simk. 10.07.1908 - beyond Aranyida (Com. Abauj-Torna), Ká. 01.07.1939 - 02.07.1939.

At Mts. High Tatra: beyond Csorba (Com. Liptó), at valley "Handel völgy", Th. 12.08.1912 - at Lake "Csorba-tó", Lándi 25.06.1908 - at valley "Furkota völgy", De. 11.08.1904; Fil., Szurák and T. 26.07.1912 - beyond Poprád (Com. Szepes), at valley "Fagyott tó völgye", beyond "Poprádi tó", De. 09.08.1904 - at valley "Felkai völgy", Staub 04.08.1874 - at valley "Tarpataki völgy", Fil. 14.07.1902 - at valley "Malá Studena dolina" beyond Poprad, Bs. 20.08. 1938 - at Lakes "Öt tó", beyond Poprad, Simk. 09.08.1907; Th. 29.08.1908 - at Tátralomnic, Per. 22.17.1907 - at Lake "Zöld tó", beyond Poprád, Simk. 07-08.07.1890; Fil. 19.08.1903; 11.08.1906.

At Mts. "Bélai Tátra": Barlangliget (Com. Szepes), beyond Poprád, Borb. 24.07.1892 - at "Vaskapu" beyond Poprád, Fil. 03.07.1900.

North-East Carpathians in Czechoslovakia and Rumania

At Mt. "Vihorlát": beyond Nagyberezna (Com. Ung), ? 04.07.1881.

At Mt. "Gutin": beyond Baia mare (Rumania), near Blidár, Ká. 22.07.1941; 23.07.1941 - Szatmár (Com. Szatmár), near to Blidár, Jáv. 21.06.1913.

At Mts. "Máramarosi havasok": Tiszabogdány (Com. Máramaros), at mountain "Goverla", Bs. 24.07.1939.

At Mt. "Pop Iván": (Com. Máramaros), Vág. 07.1868; Ká. 28.07.1942; Mar. ?; Hazsl. ?.

At Mts. "Radnai havasok": at mountain "Nagy Pietrosz", beyond Borsabánya, Fil., Jáv. 19.07. 1906; 22.07.1906; Bs. 19.07.1942 - beyond Havasmező, Jáv. 07.07.1913 - at mountain "Korongyis" (Com. Beszterce-Naszód), beyond O-Radna, De. 09.08.1902; Kümm. 18.08.1904 - at mountain "Ünökő", beyond O-Radna, Haynald 07.1860 - Radnaborberek, Kümm., De.28.08. 1904.

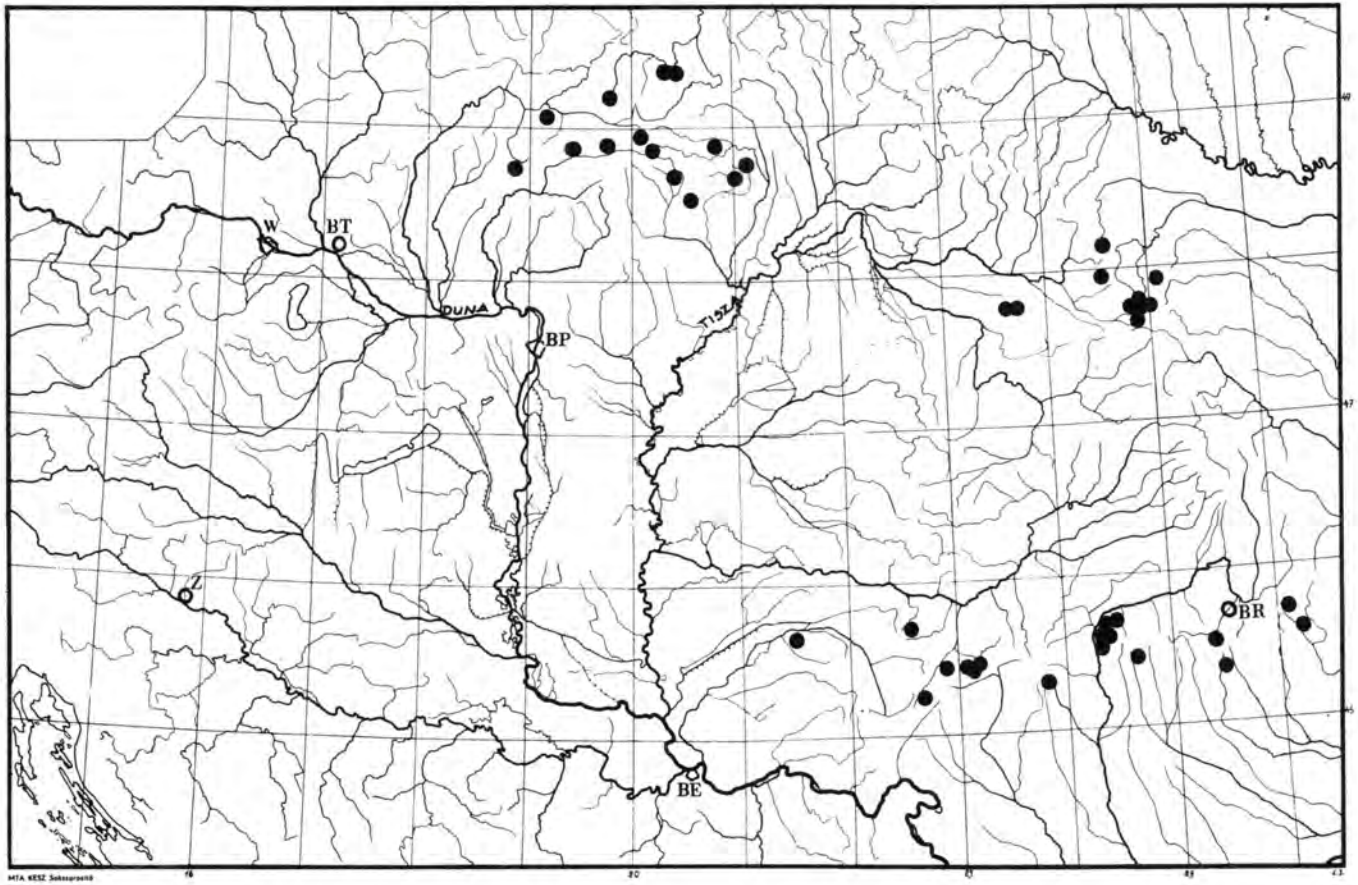
East Carpathians in Rumania

At Mts. "Csiki havasok": Balánbánya (Com. Csik), at mountain "Nagy Hagymás", De. 21.06.1901; Kümm. 15.07.1902 - at mountain "Öcsém teteje", De. 17.06.1901.

At Mts. "Berecki havasok": at mountain "Csukás" and "Piroska" (Com. Háromszék"), beyond Bodzavám, Simk. 11.07.1886 - beyond Kovászna, Jáv. 09.07.1914.

South Carpathians in Rumania

At Mts. "Brassói havasok": Felső Tömös (Com. Brassó), at mountain "Piatra Mare", Ko., De. 04.08.1903 - at mountain "Schuller", beyond Brassó, Cholnoky 20.07.1917 - at mountain "Nagykőhavas", beyond Brassó, Ká. 02.07.1935 - at mountain "Kereszténýhavas", beyond Brassó, Moesz, 04.07.1903 - 29.05.1906.



Map 2. Occurrence of Phleum commutatum Gaud in the Carpathians

At Mt. "Királykő": at "Királykő" (Com. Fogaras), beyond Zernest, De. 22.07.1902.
At Mts. "Fogarasi havasok": beyond Árpás (Com. Fogaras), Csató, 05.08.1889 - at valley "Bulea", beyond Árpás, Tuzs. 22.07.1914 - at valley "Bulea", beyond Kercisora, Zsák, De. 21.07. 1910; Th. 22.07.1914 - beyond Felső Árpás, at Lake "Bulea tó", Ká. 09.07.1935.
At Mts. "Szebeni havasok": "Gudsir" (Com. Hunyad), near Hátszeg, Vángel 07.07.1905.
At Mt. "Pareng": beyond Petrozsény (Com. Hunyad), Jáv. 19.07.1910.
At Mt. "Retyezát": beyond Petrozsény (Com. Hunyad), Csató 07.07.1860; De. 19.08.1903; Jáv. 07.1904; 02.08.1907 - at valley "Zenoga", V. 29.07.1938 - beyond "Gurasada", Ká. 28.07. 1938 - at Lake "Valeriaszka", Le. 02.08.1907.
At Mts. "Bihar hegység": beyond Felső Vidra (Com. Torda-Aranyos), Simk. 13.07.1882.

Taxonomic survey

At first I should like to deal with taxonomical problems. Phleum commutatum Gaud. was described by J. GAUDIN in 1808, but it is not considered to be an independent species by most of the authors, but a synonym, subspecies or a variety of Phleum alpinum L. or Ph. pratense L. (LINNAEUS 1853), so in this way they date back to LINNAEUS' first classification and has since been used in the majority of handbooks: ASCHERSON & GRAEBNER 1898-1902, ROUY 1913, JÁVORKA 1925, HEGI 1927, KOMAROV 1934, SZTOJANOV & SZTEFANOV 1948, DOSTÁL 1950, ROGER & BUTCHER 1961, HUBBARD 1968, SAVULESCU 1972, EHRENDORFER 1973, HESS-LANDOLF & HIRZEL 1976, TUTIN et al. 1980. Other authors made no mention of Phleum commutatum Gaud, at al., for example, MERKER 1910, SCHMEIL & FITSCHEN 1958, NORDHAGEN 1940, ROTHMALER 1962.

NORDENSKIÖLD (1945), in her detailed and careful studies of four taxa of Phleum, accepted Phleum alpinum L. and Ph. commutatum Gaud. as two independent species (referring to GREGOR & SANSOME, 1930 and GREGOR, 1931, in: NORDENSKIÖLD, l.c.). According to NORDENSKIÖLD (l.c.) these two species differ sharply in their essential character. First they were characterised by distinct chromosome numbers. Phleum alpinum L. (2n = 14) is a diploid species and Ph. commutatum Gaud (2n = 28) is a tetraploid one; this fact is confirmed by most of the cromosome atlases and floras: DARLINGTON & WYLIE 1955, LÖVE & LÖVE 1961, FEDOROV 1969, LÖVE & LÖVE 1975, TUTIN et al. 1980.

NORDENSKIÖLD (l.c.) pointed out the most important morphological differences between the two taxa too. According to this the awns of Phleum alpinum L. are quite ciliate, while in Ph. commutatum Gaud. they are subglabrous or sometimes slightly scabrous (GAUDIN 1811). The spikes of Phleum alpinum L. are more vigorous and more cylindrical than those of Ph. commutatum Gaud.

According to my observations hitherto the spikes of Phleum alpinum L. are short, wide cylindrical, ovoid - sometimes almost round - while in Ph. commutatum Gaud. they are longer and narrow cylindrical. It is the analogous case in the spikelets, in Ph. alpinum L. they are stubby than those of Ph. commutatum Gaud. where they are tightly. The awns of Ph. alpinum L. are usually curved here and there, while in Ph. commutatum Gaud. they are straight.

The shoot of Ph. alpinum L. is characterised by creeping growth written by NORDENSKIÖLD (l.c.), unfortunately this character is not easy to study on herbarium material. According to her among the four species of Phleum (Ph. nodosum L., Ph. pratense L., Ph. alpinum L., Ph. commutatum Gaud.), the Ph. commutatum Gaud. is the species which differs most distinctly from the others and hence also from Ph. alpinum L., and preferably it should not therefore be grouped with this or any other of the species. Nevertheless, according to her opinion the four species of Phleum are morphologically closely related.

According to the difference of ploid level between the two taxa every part of the diploid Ph. alpinum L. is smaller against to the tetrapoid Ph. commutatum Gaud. The longer spikes, broader and longer leaves of Ph. commutatum Gaud. than those of Ph. alpinum L. are usually extremely obvious and altogether Ph. commutatum Gaud. is a more robust and taller plant than Ph. alpinum L.

I have not made careful taxonomical study hitherto, so I am not quite sure whether Phleum commutatum Gaud. is an independent species, but it seems to be that, on the basis of the above mentioned characters, and the distribution and diversity of the two taxa in the Carpathians.

Table 1. Distribution of Phleum alpinum L. and Ph. commutatum Gaud. according to altitude

Altitude in m / Species	Mountain of medium height region						Subalpine region					Alpine region					Subnival region
	900-999	1000-1099	1100-1199	1200-1299	1300-1399	1400-1499	1500-1599	1600-1699	1700-1799	1800-1899	1900-1999	2000-2099	2100-2199	2200-2299	2300-2399	2400-2499	2500-2599
Phleum alpinum																	
Number of presence	-	-	-	-	-	5	11	14	15	9	9	10	3	4	-	-	4
per cent				6.0					69.0					20.2			4.8
Phleum commutatum																	
Number of presence	8	9	6	5	5	6	11	9	9	8	9	11	1	3	-	-	-
per cent				39.0					46.0					15.0			

Phleum alpinum: H'=3.14705 J=0.94735 N=84 S=10 Phleum commutatum: H'=3.67167 J=0.96436 N=100 S=14

Table 2. Distribution of Phleum alpinum L. and Ph. commutatum Gaud. according to habitats

Habitats / Species	Pine-woods	Mountain meadows	Subalpine meadows	Alpine meadows	Subnival vegetation
Phleum alpinum					
Number of presence	-	4	50	24	3
per cent	-	5,0	61.7	29.6	3.7
Phleum commutatum					
Number of presence	13	28	37	14	-
per cent	14.1	30.4	40.2	15.2	-

Phleum alpinum: H'=1.3400 J=0.6700 N=81 S=4 Phleum commutatum: H'=1.8631 J=0.9315 N=92 S=4

Discussion

The two Phleum taxa are recorded and divided into categories of altitudes and groups of habitats, according to the data of lebels, in Tables 1 and 2. Phleum commutatum Gaud. occurs in 14 different categories of altitudes, while Ph. alpinum L. was collected only in 10. Ph. commutatum Gaud. gives the higher diversity of altitude and habitat values, the evennes is also high.

Both of the two taxa have the highest frequency values in the subalpine region (1500-2000 m.s.m. Table 1), in subalpine meadows (about 1300-2100 m.s.m. Table 2). Beside this, Ph. alpinum L. is frequent in alpine regions, alpine meadows (about 1900-2000 - 2500 m.s.m.), against Ph. commutatum Gaud. which was collected in rather lower-lying grasslands, mountains of medium heights (900-1500 m.s.m. Table 1), in pine woods and mountain meadows (about 700-1600 m.s.m. Table 2).

This small area survey of distribution confirms NORDENSKIÖLD's (l.c.) investigations. Moreover, according to her Phleum commutatum Gaud. has the wider distribution - the widest among the four Phleum species - occurring both in the northern and southern hemispheres within the arctic regions, as well as within the greater part of the alpine and subalpine areas of the world. Phleum alpinum L. is much more limited than Ph. commutatum Gaud. This is a much discussed problem, nevertheless there is no doubt that the polyploids generally tend to have a considerably wider area of distribution than the diploids (LÖVE 1953).

According to my observations the two taxa are overlapping each other in the subalpine region in the Carpathians. Moreover, Ph. alpinum L. is spreading to higher grasslands - sometimes near the nival region - from this subalpine region, while Ph. commutatum Gaud. is growing (in high percentage) in lower mountains of medium height regions.

This is quite not in agreement with NORDENSKIÖLD (l.c.) and the generally accepted hypothesis, because according to this the polyploids might be better adapted for more extreme climates than are the diploids (HAGERUP 1931, in LÖVE 1953). Although LÖVE (l.c.) wrote that this hypothesis did not show significant differences, moreover, there are authors who claimed the opposite. For example, the Anthoxanthum alpinum Löve et Löve (was examined by OESTERGRE 1962, in FAVARGER 1967) and Lotus alpinum (DC) Schleicher (examined by LARSEN 1954 and FAVARGER 1953, in FAVARGER 1967). These two diploid taxa are living in high mountains and the tetraploids are growing in lower places (Anthoxanthum odoratum L. and Lotus corniculatus L.).

I support this latter investigation and interpret this as follows. Species in higher ploid levels are usually more distributed and generally show greater adaptability to different habitats too, for example in agricultural areas, field margins, waste places as species in lower ploid levels. In higher altitude regions of mountains, especially beyond the snow-line, they are more natural habitats, in areas not touched by people than in lower places, where they are pastures, hay fields, may be plough-lands, areas for forestry, so the species growing here must be adapted to these different circumstances.

So it seems very likely that the adaptation capacity of the tetraploid Phleum commutatum Gaud. for these different habitats is much better than of the diploid Ph. alpinum L. It seems to be supported by the fact that the herbarium specimens - are found at our herbarium and collected randomly during a long period - of Ph. commutatum Gaud. are in greater quantities than Ph. alpinum L.

Conclusion

It may be supposed that these two taxa of Phleum (Ph. alpinum L. and Ph. commutatum Gaud.) are not only ecospecies or ecotypes but they are two independent species. This is supported by NORDENSKIÖLD's (1945) careful cytological, morphological and ecological investigations.

According to my observations, the morphological differences between the two taxa and their distribution and diversity in the Carpathians seem to confirm the above mentioned, but this requires more careful cytological and morphological studies on living plants to make it a definite statement.

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