

## ENDEMIC TAXA OF VASCULAR PLANTS IN THE POLISH CARPATHIANS

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### ABSTRACT

The Carpathians, particularly their highest massif, the Tatra Mountains, exhibit the greatest richness of endemics in Poland. The present paper is a critical recapitulation of existing knowledge of endemism among the vascular plants of the Polish part of the Carpathians. It comprises a list of all 110 taxa (49 species, 26 microspecies of the genus *Alchemilla* and 35 conspicuous subspecies) that can be considered Carpathian endemics or subendemics. Their distribution, vertical ranges and habitats are characterized.

**KEY WORDS:** vascular plants, endemic taxa, classification of endemics, Polish Carpathians.

### INTRODUCTION

Endemism is a particularly important phenomenon when the vegetation history of a given area is considered. Endemics themselves are unique elements of the flora, constituting the most valuable components of the biodiversity of each area. They are also a key to understanding the main problems of the history and evolution of contemporary floras. Endemics, and particularly stenochoric endemics, are now of special interest in both national and international conservation programs. They are also placed on national and regional „red lists” and in „red books”.

Because of the geographical situation of Poland and the history of Pleistocene glaciations in its area, the share of endemics in Polish flora is small. In this respect Poland is similar to other areas in Europe subjected to the destructive activity of a continental glacier (Pawłowska 1953; Hendrych 1982). This applies in particular to lowland and upland areas devoid of or poor in endemics (Piękoś-Mirkowa et al. 1996). Endemic taxa occurring in these areas are mostly neoendemics represented by microspecies or taxa of lower rank (subspecies or varieties). In Poland, the Carpathians and especially the Tatra Mountains are distinguished by the greatest richness of endemics, expressed in the number of endemic taxa (Pawłowski 1972; Mirek, Piękoś-Mirkowa 1992a, b). Their distribution, resources and habitats in the Polish Tatras were characterized by Piękoś-Mirkowa et al. (1996).

Professor B. Pawłowski studied endemism in the flora of the Carpathians for many years, and recapitulated them in „Remarques sur l'endemisme dans la flore des Alpes et des

Carpates” (Pawłowski 1970a). This publication comprises a list of all endemics and subendemics (altogether 146 species) occurring in the area of the whole Carpathian arch, of which 42 species (excluding microspecies of the genera *Alchemilla* and *Hieracium*) occur in the northernmost Polish Carpathians. However, the development of taxonomic, cytological, genetic and phytogeographical studies during the last 30 years in both Poland and neighbouring countries has forced us to verify and re-evaluate the previous list of endemics and subendemics. As a result of detailed studies on their ranges, origin and affinities, some taxa have lost their status of Carpathian endemics, while others have been recognized as such, and particularly some newly described small apomictic species. Better knowledge of the distribution of particular taxa has brought about changes in the affiliation of some taxa to the groups of Pan-, West or East Carpathian endemics or subendemics.

The present paper synthesizes and updates the existing knowledge of endemism in the flora of the Polish Carpathians. It comprises a list of all species (with microspecies from the genus *Alchemilla*) and conspicuous subspecies, and exceptionally also varieties, presently considered Carpathian endemics or subendemics and occurring in the area of the Polish Carpathians. Among them are endemics with a wide distribution in the whole of the Carpathians, or the Western or Eastern Carpathians, as well as stenochoric endemics limited to particular Carpathian ranges (Tatras, Pieniny Mts. or Mt. Babia Góra). The authors characterized the vertical and horizontal distribution of endemic taxa, their frequency of occurrence and habitat conditions (Table 1).

TABLE 1. Endemic taxa of vascular plants occurring in the Polish Carpathians (for abbreviations see below).

Taxon	Distribution <sup>1</sup>	Altitudinal element <sup>2</sup>	Frequency <sup>3</sup>	Habitats <sup>4</sup>	Source <sup>5</sup>
* <i>Aconitum bukovinense</i> Zapał.	E, S	sa/a	v. r	grasslands, bilberry heath	Mitka 2001c
* <i>Aconitum degenii</i> Gáyér subsp. <i>degenii</i>	E, S	m	v. r	tall-herb com., alderwood, beechwood	Mitka 2001a
<i>Aconitum firmum</i> Rchb. subsp. <i>firmum</i>	C	mltz	com	tall-herb com.	Kliment 1999
* <i>Aconitum firmum</i> Rchb. subsp. <i>maninense</i> (Skalický) Starmühler	W	a	v. r	tall-herb com.	Mitka 2001d
<i>Aconitum firmum</i> Rchb. subsp. <i>moravicum</i> Skalický	W	sa	v. r	tall-herb com.	Mitka 2001e
<i>Aconitum lasiocarpum</i> (Rchb.) Gáyér subsp. <i>kotulae</i> (Pawł.) Starmühler et Mitka	(C)	m	r	tall-herb com.	Mitka 2001b
* <i>Aconitum lasiocarpum</i> (Rchb.) Gáyér subsp. <i>lasiocarpum</i>	(E)	mltz	r	tall-herb com.	Mitka 2001b
<i>Aconitum moldavicum</i> Hacq.	(C)	m	f. f	deciduous forests, tall-herb com.	Pawł. 1970a; Kliment 1999
<i>Alchemilla aequidens</i> Pawł.	W	a	v. r	springs and flushes, snow patch com.	Pawł. 1953, 1956
* <i>Alchemilla amiconum</i> Pawł.	T	a	v. r	calcareous rocks and screes	Pawł. 1953, 1956; Plocek 1992
* <i>Alchemilla babiogorensis</i> Pawł.	W, E	sa	v. r	tall-herb com.	Pawł. 1957; Volgin, Sychak 1989a; Stoyko, Tasenkevich 1993
* <i>Alchemilla bogumili</i> Pawlus	W	sa	v. r	tall-herb com.	Pawlus 1979; Plocek 1992
* <i>Alchemilla boleslai</i> Pawł.	W	a	r	grasslands, screes	Pawł. 1953, 1956; Plocek 1992
* <i>Alchemilla braun-blanquetii</i> Pawł.	W, E	a	v. r	grasslands	Pawł. 1956; Volgin, Sychak 1992; Stoyko, Tasenkevich 1993
* <i>Alchemilla calviflora</i> Plocek	T	a	v. r	calcareous rocks	Plocek 1990
* <i>Alchemilla eugenii</i> Pawł.	T	a	v. r	rocks	Pawł. 1956; 1957
* <i>Alchemilla giewontica</i> Pawł.	T	sa	v. r	rocks, screes	Pawł. 1957
* <i>Alchemilla jasiowiczii</i> Pawł.	T	a	v. r	grasslands	Pawł. 1957
<i>Alchemilla kornasiana</i> Pawł.	W, E	m	v. r	wet meadows, fens	Pawł. 1953; Volgin, Sychak 1992; Stoyko, Tasenkevich 1993
* <i>Alchemilla kulczyński</i> Pawł.	T	a	v. r	rocks, screes	Pawł. 1956
* <i>Alchemilla microsphaerica</i> S. Fröhner	W	a	v. r	grasslands	Fröhner 1968; Plocek 1992
* <i>Alchemilla oculimarina</i> Pawł.	T	sa/a	r	silicate rocks	Pawł. 1957, 1972; Plocek 1992
* <i>Alchemilla polonica</i> Pawł.	T	a	v. r	calcareous rocks, snow patch com.	Pawł. 1953, 1956
* <i>Alchemilla pseudincisa</i> Pawł.	W, E	a	r	calcareous rocks and screes	Pawł. 1956; Pawlus 1988
* <i>Alchemilla pseudothmari</i> Pawł.	T	a	v. r	calcareous grasslands	Pawł. 1953, 1956
* <i>Alchemilla pungentiflora</i> (Plocek) Plocek	E	m	r	meadows	Plocek 1986; Kliment 1999
* <i>Alchemilla sericoneuroides</i> Pawł.	W	sa	r	grasslands	Pawł. 1957; Plocek 1992
* <i>Alchemilla smytyniensis</i> Pawł.	W, E	a	v. r	calcareous grasslands	Pawł. 1953, 1956; Volgin, Sychak 1989b; Stoyko, Tasenkevich 1993
* <i>Alchemilla sokolowski</i> Pawł.	T	a	v. r	grasslands, snow patch com.	Pawł. 1956; Fröhner 1968
* <i>Alchemilla stanislaae</i> Pawł.	W	a	v. r	grasslands on silicate rocks	Pawł. 1956; Plocek 1992
* <i>Alchemilla tacikii</i> Plocek	T	a	v. r	silicate rocks	Plocek 1990
* <i>Alchemilla tatricola</i> Pawł.	T	a	r	snow patch com., screes	Pawł. 1956
<i>Alchemilla turculensis</i> Pawł.	E	mltz	f. r	meadows, tall-herb com.	Pawł. 1952; Pawlus 1981
* <i>Alchemilla wallischi</i> Pawł.	W	a	v. r	silicate screes	Pawł. 1956; Fröhner 1968; Plocek 1992
* <i>Antennaria carpatica</i> (Wahlenb.) Bluff et Fingerh. subsp. <i>carpatica</i>	C	a	r	calcareous grasslands	Chrtek, Pouzar 1962, 1985
* <i>Arenaria tenella</i> Kit.	?T	a	f. f	calcareous grasslands, screes	Pawł. 1956; Kliment 1999
* <i>Biscutella laevigata</i> L. subsp. <i>hungarica</i> Soó	(C)	mltz	f. f	rocks and grasslands	Kliment 1999
<i>Campanula polymorpha</i> Witasek	(C)	mltz	com	meadows, grasslands, tall-herb com., forests	Tacik 1971; P-Mir. et al. 1996

TABLE 1. Cont.

Taxon	Distribution <sup>1</sup>	Altitudinal element <sup>2</sup>	Frequency <sup>3</sup>	Habitats <sup>4</sup>	Source <sup>5</sup>
<i>Campanula serrata</i> (Kit.) Hendrych subsp. <i>serrata</i>	C	sa	f. r	tall-grass com., bilberry heaths, acid grasslands	Tacik 1971; P-Mir. et al. 1996
* <i>Cardaminopsis neglecta</i> (Schult.) Hayek	(C)	a	f. f	silicate screes	Pawł. 1970a; P-Mir. et al. 1996
<i>Carduus lobulatus</i> Borbás	W	m	v. r	calcareous rocks	Pawł. 1970a; Zarzycki 2001a
* <i>Carex sempervirens</i> Vill. subsp. <i>tatorum</i> (Zapał.) Pawł.	W	mltz	f. f	calcareous grasslands	Pawł. 1972
<i>Centaurea mollis</i> Waldst. et Kit.	(C)	mltz	v. r	tall-herb com.	Pawł. 1970a
<i>Cerastium tatrae</i> Borbás	(T)	a	f	screes, grasslands	Pawł. 1970a; Futák 1976; Kliment 1999
* <i>Cochlearia tatrae</i> Borbás	T	a	r	silicate screes	Pawł. 1956; Valachovič, Kochjarová 2000
<i>Crocus scepusiensis</i> (Rehmann et Woł.) Borbás	W	m	f	hay meadows	P-Mir. et al. 1996
* <i>Delphinium oxysepalum</i> Borbás et Pax	W	a	f. f	tall-herb com., grasslands	Pawł. 1956; P-Mir. et al. 1996
<i>Dentaria glandulosa</i> Waldst. et Kit.	(C)	m	f	beech woods	Pawł. 1970a; P-Mir. et al. 1996
* <i>Dianthus nitidus</i> Waldst. et Kit.	W	m	extinct	calcareous grasslands	Pawł. 1956; Zarzycki 2001b
<i>Dianthus plumarius</i> L. subsp. <i>praecox</i> (Kit.) Pawł.	W	mltz	f. f	calcareous grasslands	Pawł. 1956, 1972; P-Mir. et al. 1996
* <i>Draba aizoides</i> L. subsp. <i>zmudae</i> Zapał.	?C	a	f. f	rocks and calcareous grasslands	Kliment 1999
* <i>Erigeron hungaricus</i> (Vierh.) Pawł.	C	a	f. r	calcareous grasslands	Pawł. 1970a, b; P-Mir. et al. 1996
* <i>Erysimum pieninicum</i> (Zapał.) Pawł.	P	m	v. r	calcareous rocks	Pawł. 1946; Korzeniak 2001
* <i>Erysimum wittmannii</i> Zawadzki	C	m	r	crevices of calcareous rocks	Pawł. 1970a
<i>Euphrasia tatrae</i> Wettst.	(C)	sa/a	f. f	grasslands, tall-herb com.	Pawł. 1970a; P-Mir. et al. 1996
* <i>Festuca carpatica</i> F. Dietr.	C	sa	f. f	tall-grass com.	Pawł. 1970a; P-Mir. et al. 1996
* <i>Festuca tatrae</i> (Czakó) Degen	(W)	m	f. f	calcareous grasslands	Pawł. 1970a; P-Mir. et al. 1996
<i>Festuca versicolor</i> Tausch subsp. <i>versicolor</i>	(C)	a	f	calcareous grasslands	Pawł. 1970a; P-Mir. et al. 1996
* <i>Gentianella lutescens</i> (Velen.) Holub subsp. <i>tatrae</i> (Ronniger) Holub	W	sa/a	f. f	grasslands, tall-grass com.	Holub, Bertová 1984
* <i>Hesperis nivea</i> Baumg.	C	sa	v. r	deciduous shrubs	Pawł. 1972; Michalik et al. 2001a
* <i>Hieracium alpicola</i> Schleich. subsp. <i>ullepitschii</i> (Błocki) Zahn	C	a	r	rocks, grasslands	Pawł. 1972
<i>Hieracium carpathicum</i> Besser subsp. <i>carpathicum</i>	W	m	r	hay meadows, calcareous rocks	Mirek, P.-Mir. unpubl.
* <i>Hieracium crassipedilum</i> (Pawł. et Zahn) Chrtek jr.	W	sa/a	r	rocks and stony grasslands	Kliment 1999
* <i>Hieracium melananthum</i> (Nägeli et Peter) P.D. Sell et C. West	?W	a	v. r	calcareous grasslands	Sell, West 1976
* <i>Hieracium pinetophilum</i> (Degen et Zahn) Chrtek jr.	(T)	sa/a	?	tall-herb com., grasslands	Kliment 1999
<i>Hylotelephium argutum</i> (Haw.) Holub	C	mltz	f. f	rocks, screes, tall-herb com., tall-grass com.	Kliment 1999
<i>Jovibarba globifera</i> (L.) J. Parnell subsp. <i>preissiana</i> (Domin) J. Holub	(W, E)	mltz	f. f	calcareous rocks	Kliment 1999
<i>Knautia kitaibelii</i> (Schult.) Borbás	(W)	mltz	f. f	calcareous grasslands	Pawł. 1970a; P-Mir. et al. 1996
* <i>Leontodon pseudotaraxaci</i> Schur	C	a	f. f	grasslands, tall-grass com.	Pawł. 1970a; P-Mir. et al. 1996
* <i>Leucanthemopsis alpina</i> (L.) Heywood subsp. <i>tatrae</i> (Vierh.) J. Holub	T	a	f. f	grasslands, silicate screes, snow patch com.	Holub 1977, 1984; Kliment 1999
<i>Leucanthemum waldsteinii</i> (Sch. Bip.) Pouzar	(C)	mltz	f	tall-herb com.	Pawł. 1970a; P-Mir. et al. 1996
<i>Leucojum vernum</i> L. subsp. <i>carpathicum</i> (Spring) O. Schwarz	? (E)	m	f. r	deciduous forests	Kliment 1999
* <i>Linum extraaxillare</i> Kit.	(C)	a	f. f	tall-grass com., grasslands	Kliment 1999
<i>Luzula alpinopilosa</i> (Chaix) Breistr. subsp. <i>obscura</i> Fröhner	C	a	f	silicate screes	Fröhner 1968
* <i>Melampyrum saxosum</i> Baumg.	E	sa	v. r	billberry heaths, grasslands	Pawł. 1970; Michalik et al. 2001b

TABLE 1. Cont.

Taxon	Distribution <sup>1</sup>	Altitudinal element <sup>2</sup>	Frequency <sup>3</sup>	Habitats <sup>4</sup>	Source <sup>5</sup>
* <i>Oxytropis campestris</i> (L.) DC. subsp. <i>tatrae</i> (Borbás) Dostal	C	a	r	calcareous grasslands	Pawł. 1956; Futák 1976
* <i>Oxytropis carpatica</i> R. Uechtr.	C	a	f. r	calcareous grasslands	Pawł. 1970a; P-Mir. et al. 1996
* <i>Papaver tatricum</i> (Nyar.) Ehrend.	(T)	a	f. r	scree	Futák 1976; P-Mir. et al. 1996
* <i>Plantago atrata</i> Hoppe subsp. <i>carpatica</i> (Soó) Soó	C	a	r	grasslands	Pawł. 1972; P-Mir. 2001
* <i>Poa babiogorensis</i> Bernátová, Májovský et Obuch	B	sa	v. r	rock crevices	Bernátová et al. 1999
* <i>Poa granitica</i> Braun-Blanq. subsp. <i>granitica</i>	T	a	f. f	silicate scree	Chrték, Jirásek 1964
* <i>Poa nemoralis</i> L. subsp. <i>carpatica</i> Jirásek	W, E	sa	v. r	silicate scree	Kliment 1999
* <i>Poa nobilis</i> Skalińska	T	a	r	silicate scree	Skalińska 1955; Pawł. 1970a
* <i>Primula auricula</i> L. subsp. <i>hungarica</i> (Borbás) Soó	(W)	mltz	f. f	calcareous rocks	Kliment 1999
<i>Primula elatior</i> (L.) Hill subsp. <i>poloninensis</i> (Domin) Dostál	E, S	mltz	f. r	deciduous forests, meadows, tall-herb com.	Jasiewicz 1965; Kliment 1999
* <i>Pulsatilla slavica</i> G. Reuss	W	m	v. r	calcareous grasslands	Pawł. 1956; Goliašová 1985; P-Mir. et al. 1996
* <i>Pyrola carpatica</i> J. Holub et T. Křísa	C	a	v. r	calcareous grasslands	Holub, Křísa 1971; Kliment 1999
* <i>Ranunculus pseudomontanus</i> Schur	(C)	a	f	grasslands, silicate scree, snow patch com.	Tutin 1964; Fröhner 1968; P-Mir. et al. 1996
* <i>Salix kitaibeliana</i> Willd.	C	a	f. f	rocks, grasslands, scree	Pawł. 1970a; P-Mir. et al. 1996
* <i>Saxifraga moschata</i> Wulf. subsp. <i>dominii</i> Soó	W	a	f. f	calcareous rocks, scree, grasslands	Pawł. 1956; Pawłowska 1960
* <i>Saxifraga moschata</i> Wulf. subsp. <i>kotulae</i> S. Pawł.	T	a	f. f	silicate rocks, scree, grasslands	Pawłowska 1960, 1977
* <i>Saxifraga wahlenbergii</i> Ball	W	a	f	rocks, scree	Pawł. 1956; Pawłowska 1966
<i>Scilla kladnii</i> Schur	(C)	m	f. r	deciduous forests	Trávníček 1996
<i>Sempervivum wettsteinii</i> Letz subsp. <i>wettsteinii</i>	C	a	f. f	rocks, scree, stony grasslands	Letz, Marhold 1998 Pawł. 1972; P-Mir. et al. 1996
* <i>Sesleria tatrae</i> (Degen) Deyl	(W)	mltz	f	calcareous grasslands	Pawł. 1970a
<i>Silene nutans</i> L. subsp. <i>dubia</i> (Herbich) Zapal.	E	a	v. r	rocks	Pawłowska 1963; P-Mir. et al. 1996
<i>Soldanella carpatica</i> Vierh.	W	mltz	com	forests, grasslands, tall-herb com.	Kliment 1999
<i>Soldanella hungarica</i> Simonkai subsp. <i>major</i> (Neilr.) S. Pawł.	? (C)	m	f. r	coniferous forests	Kliment 1999
<i>Soldanella pseudomontana</i> F.K. Mey.	C	m	v. r	coniferous forests	Pawł. 1970a
<i>Symphytum cordatum</i> Waldst. et Kit. ex Willd.	(C)	m	f	beechwoods	Kliment 1999
<i>Taraxacum nigricans</i> (Kit.) Rchb. s. str.	W	mltz	f. f	wet places, stony grasslands	Tacik 1980
* <i>Taraxacum pawlowskii</i> v. Soest	T	a	v. r	snow patch com.	Pawł. 1924; Zarzycki et al. 2001
* <i>Taraxacum pieninicum</i> Pawł.	P	m	v. r	rock crevices	Osvačilová 1983; Kliment 1999
* <i>Thalictrum minus</i> L. subsp. <i>carpaticum</i> (Kotula) Osvačilová	T	a	f. r	calcareous grasslands, tall-herb com.	Pawł. 1970a; P-Mir. et al. 1996
<i>Thymus carpaticus</i> Čelak.	(W)	mltz	f	calcareous grasslands	Pawł. 1970a; P-Mir. et al. 1996
<i>Thymus pulcherrimus</i> Schur	C	mltz	f	calcareous grasslands	Pawł. 1970a; P-Mir. et al. 1996
* <i>Trifolium orbelicum</i> Velen. subsp. <i>monticolum</i> (Domin) Májovský	(T)	a	f. f	calcareous grasslands and scree, tall-herb com.	Kliment 1999
* <i>Trifolium pratense</i> L. subsp. <i>kotulae</i> (Pawł.) Sojak	C	a	f. r	calcareous grasslands	Pawł. 1956; Jasičová 1988
<i>Trisetum flavescens</i> (L.) Beauv. subsp. <i>tatricum</i> Chrték	C	sa	r	grasslands	Pawł. 1949; Kliment 1999
* <i>Trisetum fuscum</i> (Kit. ex Schult.) Roem. et Schult.	C	a	f. r	tall-grass com.	Pawł. 1970a; P-Mir. et al. 1996

\* – taxon restricted in the Polish Carpathians to one range only.

<sup>1</sup> Abbreviations used in the „Distribution” column: B – Babia Góra endemic; C – Pan-Carpathian endemic; (C) – Pan-Carpathian subendemic; E – East Carpathian endemic; (E) – East Carpathian subendemic; P – Pieniny endemic; S – South Carpathian endemic; T – Tatra endemic; (T) – Tatra subendemic; W – West Carpathian endemic; (W) – West Carpathian subendemic.

<sup>2</sup> Abbreviations used in the „Altitudinal element” column: a – alpine; sa – subalpine; m – montane; mltz – multizonal-mountain.

<sup>3</sup> Abbreviations used in the „Frequency” column: com – common; f – frequent; f. f – fairly frequent; f. r – fairly rare; r – rare; v. r – very rare.

<sup>4</sup> Abbreviations used in the „Habitats” column: com. – plant community.

<sup>5</sup> Abbreviations used in the „Source” column: Pawł. – B. Pawłowski; P-Mir. – Piękoś-Mirkowa.

## MATERIAL AND METHODS

The compilation of the list of endemic taxa (Table 1) was based on the newest critically revised data from literature as well as the results of the authors' own studies of the distribution and habitat conditions of endemics in the Tatra Mountains (Piękoś-Mirkowa et al. 1996), and unpublished data on the Carpathian endemics. The nomenclature of the taxa follows, with a few exceptions, Mirek et al. (2002).

## GENERAL FEATURES OF THE STUDY AREA

The Carpathians are young mountains of Tertiary age, belonging to the Alpine system. They represent a separate phytogeographical unit at the rank of division within the Central European Mountain Province (Pawłowski 1972). The Carpathians as a whole constitute an arch over 1300 kilometres long stretching through Poland, Slovakia, Ukraine, Romania and Hungary.

The Polish Carpathians, situated in the southern part of the country (Fig. 1), occupy the northernmost part of the whole chain. They are ca 330 kilometres in length, reaching up to 90 kilometres in width, and cover an area of 19.600 km<sup>2</sup>. The Polish Carpathians cover ca 6% of Poland and 9.3% of the whole Carpathian chain (Warszyńska 1995). A large part within the borders of Poland belongs to the Western Carpathian subdivision which occupies 17.100 km<sup>2</sup> (87%). The much smaller remaining part, covering 2.500 km<sup>2</sup> (13%), is represented by the Eastern Carpathians.

On the basis of differences in geological substrata, relief, elevation, landscape and plant cover, four phytogeographical districts within the Polish Western Carpathians are distinguished. They are the Tatras, the Pieniny Mts., the Beskidy Mts. and the Carpathian Foothills. The Polish Eastern Carpathians comprise the Bieszczady Mts. belonging to the Forest Carpathian district and the Przemyśl Foothills.

Despite the small area of the Polish Carpathians, its flora is relatively rich, encompassing ca 1700 vascular plant spe-

cies, native and established aliens (Mirek, Piękoś-Mirkowa 1992a). It includes ca 74% of the total flora of the country. Among them more than 450 species are represented by the mountain element.

## LIST AND CHARACTERISTICS OF ENDEMIC TAXA

For each taxon shown in Table 1, the distribution pattern, altitudinal element, frequency of occurrence and preferred habitat are given. Taxa with a question mark require further study on their distribution or taxonomical position and variability range, to define their status or category of endemism. Hybrids are not included in the list of endemics and subendemics. Moreover, for various reasons, several taxa classified by other authors as endemics or subendemics are excluded. For example, *Artemisia absinthium* L. var. *calcigena* Rehman, *Centaurea triumfettii* All. var. *pieninica* Pawł., *Minuartia setacea* (Thuill.) Hay. var. *pienina* (Zap.) Pawł., *Sedum acre* L. var. *calcigenum* Woł., restricted to the Pieniny range (Pawłowski 1972; Zarzycki 1976), were eliminated because they are probably of little taxonomical value. From among two *Alchemilla* species not listed in Table 1, *A. walasii* appeared to be more widespread, having numerous stations outside of the Carpathians in their forelands and in northeastern Poland (Zajac, Zajac 2001). The second species, *A. ladislai*, described as a local Tatra endemic by Pawłowski (1953), requires taxonomical revision because the type material is heterogenous (Plocek 1992).

## RESULTS AND DISCUSSION

In the flora of the Polish Carpathians there are 110 taxa presently considered Pan-, West and East Carpathian endemics or subendemics, or endemic to individual Carpathian ranges (Tatras, Pieniny Mts., Mt. Babia Góra). Among them there are 49 taxa assigned by the majority of authors to species, 35 subspecies and 26 microspecies of the genus *Alchemilla*.

Taking into account their general distribution, the endemics and subendemics occurring in the Polish Carpathians have been divided into 13 groups, with the following numbers of taxa:

- Pan-Carpathian endemics – 23,
- Pan-Carpathian subendemics – 15,
- Endemics of the Western and Eastern Carpathians – 6,
- Subendemics of the Western and Eastern Carpathians – 1 subspecies,
- Endemics of the Western Carpathians – 24,
- Subendemics of the Western Carpathians – 5,
- Endemics of the Tatra Mts. – 20,
- Subendemics of the Tatra Mts. – 4,
- Endemics of the Pieniny Mts. – 2,
- Endemics of Mt. Babia Góra – 1 species,
- Endemics of the Eastern Carpathians – 4,
- Subendemics of the Eastern Carpathians – 2,
- Endemics of the Eastern and Southern Carpathians – 3.

In the light of recent studies of their distribution and taxonomy, of the 42 species mentioned by Pawłowski (1970a) from the area of the Polish Carpathians, seven species have lost the status of endemics or subendemics. From

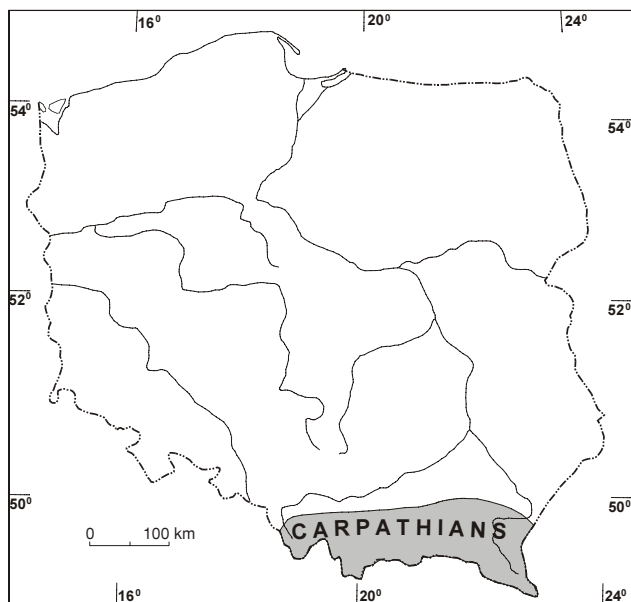


Fig. 1. The area covered in this paper – hatched.

among four species hitherto considered Pan-Carpathian subendemics, *Petasites kablikianus* appeared to have a wider distribution, occurring in the Carpathians, Sudety Mts. and the Balkan Peninsula (Kliment 1999), *Melampyrum herbichii* is a Carpathian-Sudetic species (Kliment 1999), *Erigeron macrophyllus* a Carpathian-Alpine species (Gutermann 1974), and *Saxifraga carpatica* a species with a Carpathian-Balkan-East-Alpine distribution pattern (Schnee-weiss 1998). From among the East Carpathian species, *Viola declinata* has lost the status of endemic and *Senecio papposus* of subendemic; both species have a Carpathian-Balkan distribution pattern. Moreover, *Festuca aglochis*, regarded by Pawłowski (l.c.) as a Tatra endemic, appears to be only an aberration of *Festuca airoides*, of no taxonomic value (Futák 1971, 1972, 1976). As a result of detailed taxonomical studies, three *Alchemilla* species (*A. subconnivens*, *A. kotulae* and *A. subtatica*) regarded previously as endemics appear to be conspecific with other nonendemic ones (Fröhner 1968; Walters 1968; Rothmaler 2002). Four species, *Alchemilla calvijflora* (Plocek 1990), *Alchemilla pungentiflora* (Plocek 1986), *A. tacikii* (Plocek 1990) and *Poa babiogorensis* (Bernatova et al. 1999), described in recent years, appear to be Carpathian endemics occurring in Poland. Some endemic taxa are restricted only to the Polish Carpathians, for example *Alchemilla giewontica*, *Erysimum pieninicum* and *Taraxacum pieninicum*.

In the course of chorological studies by many authors, several taxa have changed their category of endemism. For example, *Sesleria tatrae*, considered endemic to the Western Carpathians, has been reported also from single stations in the Sudetes, thus it is a West Carpathian subendemic. Moreover, five *Alchemilla* species (*Alchemilla babiogorensis*, *A. braun-blanquetii*, *A. kornasiana*, *A. pseudincisa*, *A. smytniensis*) regarded as highly stenochoric endemics limited to a single mountain massif (the Tatras or Mt. Babia Góra) have been discovered in the Ukrainian Carpathians as well; consequently they should be classified as West and East Carpathian endemics (Pawlus 1988; Volgin, Sychak 1989a, b, 1992; Stoyko, Tasenkevich 1993).

Different authors classify some endemic taxa in different categories. For example, *Delphinium oxysepalum*, *Saxifraga wahlenbergii* and *Cerastium tatrae* are assigned to the group of West Carpathian endemics or the group of Tatra subendemics (Pawłowski 1970a, 1972; Futak 1976; Kliment 1999). Depending on the scope, the same taxon can be classified as a Pan-Carpathian endemic or West Carpathian endemic, for example *Campanula polymorpha* Witaszek.

The obtained results show that studies on the taxonomy, distribution and ecology of endemic taxa should cover the whole of the Carpathians, which are a separate phytogeographical unit (biome).

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## ENDEMICZNE TAKSONY ROŚLIN NACZYNIOWYCH W KARPATACH POLSKICH

### STRESZCZENIE

We florze Karpat polskich stwierdzono 110 taksonów (tj. 49 traktowanych przez większość autorów w randze gatunków, 35 w randze podgatunków, 1 odmianę i 26 „drobnych gatunków” z rodzaju *Alchemilla*), które reprezentują element endemiczny. W tej liczbie znajdują się 23 endemity i 15 subendemitów ogólnokarpaccich, 6 endemitów i 1 takson subendemiczny dla Karpat Zachodnich oraz Wschodnich, 24 endemity i 5 subendemitów zachodnio-karpaccich, 4 endemity i 3 subendemity wschodnio-karpaccie oraz 3 taksony endemiczne dla Wschodnich i Południowych Karpat. Ponadto trzy spośród pasm Karpat polskich posiadają własne endemity. Są to Tatry (20 taksonów endemicznych i 4 subendemiczne), Babia Góra (1 takson endemiczny – *Poa babiogorensis*) oraz Pieniny (2 endemity: *Erysimum pieninicum* i *Taraxacum pieninicum*). Cztery inne taksony (*Artemisia absinthium* var. *calcigena*, *Centaurea triumfettii* var. *pieninica*, *Minuartia setacea* var. *pienina*, *Sedum acre* var. *calcigenum*) uważane przez dawniejszych badaczy za endemiczne dla Pienin, wydają się mieć małą wartość taksonomiczną.

Dokładne badania prowadzone w różnych częściach Karpat, na temat rozmieszczenia poszczególnych taksonów, spowodowały również zmiany w zaklasyfikowaniu niektórych z nich do określonych kategorii endemitów. Konsekwencją znalezienia ostatnio w Karpatach ukraińskich kilku gatunków z rodzaju *Alchemilla*, uważanych wcześniej za endemity tatrzańskie, jest zaliczenie ich obecnie do kategorii endemitów Zachodnich i Wschodnich Karpat.

Jak starano się wykazać, liczby taksonów endemicznych w poszczególnych pasmach karpaccich, jak również ich status, zmieniają się w miarę postępu badań taksonomicznych i chorologicznych. Prowadzi to do konkluzji, że badania nad taksonami endemicznymi należy prowadzić w skali całych Karpat, które stanowią wybitnie odrębną jednostkę fitogeograficzną (biom).

**SŁOWA KLUCZOWE:** rośliny naczyniowe, taksony endemiczne, klasyfikacja endemitów, Karpaty polskie.