Species of vascular plants endemic to the Krkonoše Mts (Western Sudetes)

Endemické druhy cévnatých rostlin v Krkonoších

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D e d i c a t e d t o M a r c e l R e j m á n e k

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This paper summarizes the present state of knowledge of the vascular plants endemic to the Krkonoše Mts. The species given in previous lists but excluded from the present one are also discussed together with the history of opinion of their status. Some endemics are of Holocene age, e.g. *Sorbus sudetica* is the result of a past hybridization while others originated from continuous differentiation of small populations over time. Some endemic species of other genera, for example, *Hieracium, Taraxacum* and *Alchemilla* appear to be older in origin, representing relict populations which occurred at low altitudes at least during the last glacial period. Their age is unknown, because it is unknow, when and how they evolved.

K e y w o r d s : apomicts, Czech Republic, endemics, Krkonoše, origin, Poland, small population differentiation

Introduction

In general, outside the high mountain areas of the Alps and the Carpathians, endemic species are relatively very rare in Central Europe. As usual, the list of endemics is dependent on taxonomic treatment; especially the rank of the taxon. Lists of endemics of the Czech Republic are surprisingly rare: Hadač (1977) published an annotated list, Holub et al. (1979) a list of endemics of the Czech Republic (category BI in their classification) and of endemics shared with other countries (BII). Among the few endemic species occurring at lower altitudes in the Czech Republic are *Dianthus arenarius* subsp. *bohemicus* (Novák) O. Schwarz and *Pinguicula bohemica* Krajina. Several taxa, including *Cerastium alsinifolium* Tausch, *Knautia arvensis* subsp. *serpentinicola* Smejkal (Štěpánek 1997) and *Minuartia smejkalii* Dvořáková (Dvořáková 1990) occur on serpentine. A further set of endemics, known from river canyons or regions with treeless, usually rocky areas, includes *Dianthus moravicus* (canyons of the Želetavka, Rokytná, Jihlava and Dyje rivers in S Moravia – cf. Kovanda 1990), *Cortusa matthioli* subsp. *moravica* (Podp.) Soják (Macocha abyss, S Moravia; Kovanda 1992a) and a group of hybridogenous *Sorbus* species (Kovanda 1992b, 1996a, b). This latter group includes *S. eximia* (karst area of the Český kras), *S. bohemica* (volcanic hills of the České středohoří highlands), *S. alnifrons* Kovanda (Templštýn in the canyon of the Oslava river), *S. gemella* Kovanda (rock outcrops in the area of Džbán), *S. quernea* Kovanda (rocky area in Prague, in the canyon of the Vltava river), *S. hardeggensis* Kovanda (canyon of the Dyje/Thaya river) and *S. rhodanthera* Kovanda (isolated rocky parts of

Chlumská hora near Manětín). *Campanula gentilis* Kovanda (Kovanda 2000) occurs on rocks in SW part of Bohemia and adjacent Bavaria. In mountain areas above the timberline, summit areas and glacial cirques were treeless during the Holocene and this allowed the survival of small and isolated populations of many species.

Of the mountain ranges in the Czech Republic, only the Sudetes extend above the timberline at the altitude of 1250 m in the Krkonoše and ca 1350 m in the Králický Sněžník and Hrubý Jeseník. Each of these mountain ranges harbour several endemic species, a number of which occur in all three areas, including *H. schustleri* Zlatník, *H. chrysostyloides* (Zahn) Chrtek jun., and *H. atratum* Fries (Chrtek 2004), while as indicated below some species have more fragmented distributions.

The Králický Sněžník/Śnieżnik Kłódzki (Glatzer Schneeberg in German) has a very small alpine area with an endemic species, viz. *Hieracium nivimontis* (Oborny & Zahn) Chrtek jun., not found elsewhere in the Sudetes. *Aconitum plicatum* subsp. *sudeticum* Mitka and *A.* × *berdaui* nsubsp. *walasii* (Mitka in Starmühler & Mitka) Mitka (Mitka 2003) are endemic to the Králický Sněžník and the Hrubý Jeseník Mts, while *Hieracium uechtritzianum* G. Schneider also occurs in the Krkonoše (Chrtek 2004).

There are a larger number of endemics in the Hrubý Jeseník Mts range (Hohe Gesenke in German), including *Campanula gelida* Kovanda (Kovanda 2000), *Carlina biebersteinii* subsp. *sudetica* Kovanda (Kovanda 2002), *Dianthus carthusianorum* subsp. *sudeticus* Kovanda (Kovanda 1990), *Plantago atrata* subsp. *sudetica* (Pilger) Holub (Chrtek 2000) and *Poa riphaea* (Aschers. et Graebn.) Fritsch (Holub 1999b), in addition to the three species mentioned above found in the Králický Sněžník Mts. Several others, endemic to the Hrubý Jeseník, including *H. chlorocephalum* Uechtr. and *Campanula rotundifolia* subsp. *sudetica* (Hruby) Soó (Kovanda 2000), also occur in the Krkonoše.

The area of the Krkonoše/Karkonosze Mts (Riesengebirge in German) is one of the regions with a relatively large number of endemic taxa. Surprisingly, there have been few attempts to list them and their critical evaluation has been inadequate. The first complete list was published by Šourek (1969a, b). Some years later, Hadač published corrected lists in 1977 and 1983 (Hadač 1977, 1983). These two lists are not identical nor is there any discussion why some species were added or excluded. There are no complete lists for the northern (at the end of the Second World War German, at present Polish) side of the mountains. Fabiszewski (1985) accepts only two endemic taxa, *Saxifraga moschata* subsp. *basaltica* and *Campanula corcontica* (= *C. bohemica*). Kącki et al. (2003) mention *Campanula bohemica*, *Taraxacum alpestre*, *Saxifraga *basaltica*, *Pimpinella *rupestris*, *Carex pallescens* var. *alpestris* and several *Hieracium* species. Pender (2003) published a list of endemics occurring on the Polish side of the mountains. Szeląg (2003) gives a complete list of endemic species of *Hieracium* subgen. *Hieracium*. For this reason I have prepared a list, based mainly on the ongoing revision of the Flora of the Czech Republic and subsequent publications. I also give reasons for excluding particular species.

Results

Table 1 compares the list of endemics given by Šourek (1969a, b) and Hadač (1977, 1983) with the list based on present knowledge. Endemic species such as *Sorbus sudetica* and some *Hieracium* taxa are present in all three lists. However, many species have been re-

moved and several added. This reflects ongoing changes in taxonomy and for this reason, I think this new list will again change in the light of the results of future botanical research.

Discussion

The number of endemic taxa occurring in the Krkonoše Mts is higher than in the mountain areas of the Hrubý Jeseník or Králický Sněžník. The endemic taxa are concentrated in the areas around the summit or in glacial cirques. Significantly, the frequency and size of cirques and treeless summits is greatest in the Krkonoše and smallest in the Králický Sněžník. This clearly indicates why the Krkonoše is richer in endemic species than either of the other two ranges. The ecological explanation for the presence of treeless localities is based on the theory of anemo-orographic systems (Jeník 1961, 1990). In the Krkonoše, there are about 10 well-developed glacial cirques, with frequent avalanches removing both trees (especially spruce) and weathered bedrock and so making environmental conditions less homogeneous. The influence of different rocks rich in bases, such as porphyrite, basalt and limestone is, therefore, more pronounced. In the Hrubý Jeseník, most of the endemic taxa are concentrated in two glacial cirques where frequent avalanches occur or in summit areas nearby. In the Králický Sněžník there are no cirques. There is only one avalanche path, with infrequent avalanches and no removal of weathered material (Krahulec 1990). Endemic *Hieracium* taxa are confined to the summit area.

In this section, I shall discuss the individual groups of endemics. The reasons why some were excluded are given in the Table 1. Most of the endemics are of relatively recent origin (see below) and for that reason their taxonomy is not stabilized. For example, it is not clear if the populations in the Krkonoše Mts should be considered as species or subspecies. There is no definite criterion for such a decision and it depends on how an author views the species concept. In the past, the prevailing philosophy of splitting tended to consider many of them as species, but the context and comparisons with related populations led sometimes to a decrease in rank to subspecies level. One such species is *Campanula bohemica* Hruby (= *C. corcontica* Šourek). The decision whether this taxon should be treated as a species or subspecies is dependent on how the population from the Hrubý Jeseník Mts is evaluated from a taxonomic point of view. *Campanula gelida* and *C. bohemica* differ morphologically from *C. scheuchzeri* from the Alps. For that reason, the Sudetic populations are sometimes considered either to be two independent species, *C. bohemica* Hruby and *C. gelida* Kovanda (e.g. Kovanda 2000) or one species, viz. *C. bohemica* with two subspecies: subsp. *bohemica* and subsp. *gelida* (Kovanda) Kovanda (e.g. Kovanda 1977). A similar situation arises with the taxonomic treatment of *Pedicularis sudetica* Tausch, where the population from the Krkonoše Mts differs from those in the Arctic. For Hultén (1961) this difference indicates subspecies; this approach was adopted by Hrouda (2000). However, a more recent study of Arctic types (Molau & Murray 1996) concluded they are independent species and considered the populations from the Krkonoše to be an endemic species, *Pedicularis sudetica* s. str.

Thus, the taxonomic status of *Saxifraga *basaltica* is also questionable. In Central European literature, *S. moschata* is considered to be an independent species (Braun-Blanquet 1922, Huber 1961–1966, Hrouda & Šourková 1992, Kaplan 1995, Mirek et al. 2002). In the first edition of Flora Europaea (Webb 1964), *S. moschata* is treated as an independent

Table 1. – List of taxa of vascular plants endemic to the Krkonoše Mts given by Šourek (1969) and Hadač (1987, 1983) and their present status as evaluated in this paper. Aggregate species are in bold.

Šourek 1969	Hadač 1977, 1983	Krahulec (this study)
Considered as endemics today		
		Alchemilla corcontica Plocek (= *A. nebulosa* auct., *A. wichurae* auct.)
Campanula corcontica Šourek (= *C. bohemica*)	*Campanula bohemica* Hruby	*Campanula bohemica* Hruby
		Carex viridula Michx. subsp. *„pseudoscandinavica“*
Euphrasia micrantha var. *corcontica* Smejkal	*Euphrasia micrantha* var. *corcontica* Smejkal	*Euphrasia corcontica* (Smejkal) Smejkal et Dvořáková
		Knautia arvensis subsp. *pseudolongifolia* (Szabó) O. Schwarz
		Minuartia corcontica Dvořáková
		Pedicularis sudetica Willd. s. str. (= *P. sudetica* subsp. *sudetica*)
Pimpinella saxifraga subsp. *rupestris* Weide		*Pimpinella saxifraga* subsp. *rupestris* Weide
Primula elatior var. *corcontica* Domin		*Primula elatior* subsp. *corcontica* (Domin) Kovanda
Sorbus sudetica (Tausch) Fritsch	*Sorbus sudetica* (Tausch) Fritsch	*Sorbus sudetica* (Tausch) Fritsch
Saxifraga moschata subsp. *basaltica* Br.-Bl.		*Saxifraga moschata* subsp. *basaltica* Br.-Bl.
Salix lapponum var. *daphneola* (Tausch) Wimmer		*Salix lapponum* var. *daphneola* (Tausch) Wimmer
		Taraxacum alpestre (Tausch) DC.
*Hieracium**		
		***H. alpinum* agg.**
H. alpinum subsp. *melanocephalum* (Tausch) Zahn	*H. melanocephalum* Tausch	*H. melanocephalum* Tausch
H. tubulosum (Tausch) Tausch	*H. tubulosum* (Tausch) Tausch	*H. tubulosum* (Tausch) Tausch; this species was once found outside the Krkonoše (Chrtek 2004: 573)
		***H. corconticum* agg. (*H. nigrescens* < *H. prenanthoides*)**
H. asperulum Freyn	*H. corconticum* Knaf subsp. *asperulum* (Freyn) Zahn	*H. asperulum* Freyn
H. corconticum Čelak.	*H. corconticum* subsp. *corconticum*	*H. corconticum* Čelak.
		***H. fritzei* agg.** (*H. alpinum* > *H. prenanthoides*)
	H. fritzei F. W. Schultz	*H. fritzei* F. W. Schultz
	H. nigrostylum Zlatn.	*H.nigrostylum* Zlatn.
	H. rohlenae Zlatn.	*H. rohlenae* Zlatn.
	H. schneiderianum Zlatn.	*H. schneiderianum* Zlatn.
H. glandulosodentatum Uechtr.	*H. glandulosodentatum* Uechtr.	*H. glandulosodentatum* Uechtr. (*H. lachenalii* – *H. nigrescens*)
		***H. gombense* agg. (*H. epimedium* – *H. atratum*)**
H. purkynei Čelak.	*H. gombense* subsp. *purkynei* (Čelak.) Zahn	*H. purkynei* Čelak. (extinct, exterminated by botanists!)
		***H. nigrescens* agg. (*H. alpinum* > *H. murorum*)**
H. apiculatum Tausch	*H. apiculatum* Tausch	*H. apiculatum* Tausch
	H. decipiens Tausch	*H. decipiens* Tausch; status is unclear because it is not known if populations from the Carpathians are identical with those from the Krkonoše (Chrtek 2004: 576)
	H. nigrescens Willd.	*H. nigrescens* Willd.
		***H. juranum* agg. (*H. murorum* < *H. prenanthoides*)**
H. pseudalbinum Uechtr.	*H. juranum* subsp. *pseudalbinum* (Uechtr.) Zahn	*H. pseudalbinum* Uechtr.
		***H. sudeticum* agg. (*H. alpinum* – *H. prenanthoides*)**

H. pedunculare Tausch	*H. pedunculare* Tausch.	*H. pedunculare* Uechtr.; this species was once found outside the Krkonoše (Chrtek 2004: 594)
H. riphaeum Uechtr.	*H. riphaeum* subsp. *riphaeum* *H. riphaeum* subsp. *micradenophyllum* Zahn	*H. riphaeum* Uechtr. (***H. alpinum* < *H. prenanthoides***)
		***H. umbrosum* agg. (*H. murorum* > *H. prenanthoides*)**
H. albinum Fries	*H. umbrosum* subsp. *albinum* Fries	*H. albinum* Fries
H. rupigenum Čelak.	*H. saxifragum* subsp. *celakovskyanum* Arvet-Touvet	*H. saxifragum* (***H. lachenalii* – *H. schmidtii***) subsp. *celakovskyanum* Arvet-Touvet
Unclear		
	H. diaphanoides subsp. *microdontophyllum* Zahn *H. haematopodum* subsp. *leiochlorum* Zahn *H. kablikianum* Zlatn. *H. vulgatum* subsp. *cacuminellum* Zahn *H. vulgatum* subsp. *nigricolor* Zahn	Taxonomic value not clear, cf. Chrtek 2004: 564
		***H. fritzei-saxifragum* agg.**
H. mariae-bornmuellerianae Zahn		*H. mariae-bornmuelleriae* Zahn: unclear taxon, no plants corresponding to the description known (Szeląg 2003: 207)
H. riphaeoides Bornm. et Zahn		Because no specimen exists the interpretation of this name is uncertain – Chrtek 2004: 598
		***H. prenanthoides* agg.**
H. prenanthoides subsp. *fiekii* (Uechtr.) Zahn	*H. prenanthoides* subsp. *fiekii*	The whole group is insufficiently understood, cf. Chrtek 2004: 588, from the field known from several localities (Szeląg 2003: 208)
H. prenanthoides subsp. *pseudo-fiekii* Zahn		
H. pseudeximium (G. Schneider) G. Schneider	*H. pseudeximium* (G. Schneider) Zlatn. (= *H. nigritum* Uechtr.)	Not endemic, cf. Chrtek 2004: 598-600
Swertia perennis var. *lutea* Šourek		Not endemic, taxonomically unimportant variant, cf. Kirschner et Kirschnerová 2000 (from the context, but the name var. *lutea* Šourek not explicitely cited there)
Excluded		
		Carex pallescens var. *corcontica* Kwiatkowski (Kwiatkowski 2000); Kwiatkowski synonymized this variety with *C.p.* var. *alpestris* Čelak. and with *C.p.* var. *glaberrima* Koch. *Carex pallescens* var. *glaberrima* is reported also from the Pyrenees, the Alps, and the Krkonoše Mts. (Kükenthal 1958). For this reason it cannot be considered as endemic plant of the Krkonoše. Even its taxonomic status is unclear because Schultze-Motel (1980) considered var. *glaberrima* as taxonomically unimportant.
	Galium sudeticum Tausch	*Galium sudeticum* is not endemic; some years ago it was found in the glacial cirque of Velká kotlina in the Hrubý Jeseník Mts. It is not known if it still occurs there. It has recently been reported from serpentines in the Slavkovský les Mts. (Štěpánková & Kaplan 2000).

Šourek 1969	Hadač 1977, 1983	Krahulec (this study)
Hieracium* subg. *Hieracium		
H. bohemicum Fries (= *H. sudeticum* Sternb.)		This species was once found outside the Krkonoše (Chrtek 2004: 596); *H. sudeticum* Sternb. has been recently reported from the Romanian Carpathians (cf. Chrtek 2004: 596)
	H. conspurcans subsp. *punctatulum* Zahn	erroneous – cf. Chrtek 2004: 624
	H. liptoviense subsp. *subglaucelliforme* Zahn	cf. Chrtek 2004: 625
	H. uechtritzianum (G. Schneider) Zlatn.	Occurs also on the Králický Sněžník/Śnieżnik Kłódzki– cf. Chrtek 2004: 585
	H. tauschianum Zlatn. (= *H. uechtritzianum* G. Schneider)	Occurs also on the Králický Sněžník/Śnieżnik Kłódzki – cf. Chrtek 2004: 585
	H. krajinae Zlatn. (= *H. uechtritzianum*)	Occurs also on the Králický Sněžník/Śnieżnik Kłódzki – cf. Chrtek 2004: 585
	H. schustleri Zlatn.	Occurs also on the Králický Sněžník/Śnieżnik Kłódzki – cf. Chrtek 2004: 573-574
H. subortum G. Schneider	*H. subortum* G. Schneider (= *H. glaucinum* Jordan)	Not endemic, cf. Chrtek 2004: 558-559
	H. luteistylum Zlatn. (= *H. schneiderianum*)	Conspecific with *H. schneiderianum*, which is endemic
	H. tortuosum Tausch (= *H. decipiens*)	Conspecific with *H. decipens*, which is endemic
		***H. atratum* agg. (*alpinum* < *murorum*)**
H. polycephalum Velen.	*H. kavinae* Zlatn., *H. polycephalum* Velen. *H. sternbergii* Zlatn. *H. velenovskyanum* Zlatn.	*H. atratum* Fries (syn.*: H. subnigrescens*, *H. polycephalum*, *H. kavinae*, *H. sternbergii*, *H. sudeticola*, *H. velenovskyanum*). The position of a set of microspecies from the *H. atratum* group is unclear – cf. Chrtek 2004: 578-580; *H. atratum* itself is not endemic to the Krkonoše Mts.
Hieracium* subgen. *Pilosella		Hawkweeds of the subgen. *Pilosella* represent a group where evolution is now proceeding rapidly. Continuous hybridization produces new genotypes, both apomictic and sexual, and the same morphotypes occur repeatedly, even in different mountain ranges. For these reasons it is impossible to use the same approach as in subgen. *Hieracium*. In such a case at least, hundreds of species could be recognized. A survey of types reported from the Krkonoše Mts. is given by Krahulec et al. 2004.
	H. apatelium subsp. *pratigenum* Naegeli et Peter	
H. goderianum Uechtr. (= *H. blyttianum*)	*H. blyttianum* subsp. *latibracteatum* Peter	
	H. zizianum subsp. *petasodes* Naegeli et Peter	cf. Chrtek 2004: 693; the occurrence of this hybridogenous species is not probable because of absence of parental species; both of them grow only on the foothills of the Krkonoše Mts.
	H. hyperboreum subsp. *subhyperboreum* Peter = *H. arvicola* subsp. *subhyperboreum* (Peter) Zahn	cf. Chrtek 2004: 690
	H. iseranum subsp. *anguinescens* Zahn	
	H. iseranum subsp. *subfoviculatum* Zahn	
H. rubripilosella G. Schneider	*H. cernuatum* subsp. *rubripilosella* G. Schneider	It is unclear what is the origin of this type; original specimens do not exist and this morphological type does not now occur in the field. A type with similar morphology is produced by back hybridization of *H. rubrum* and *H. pilosella.*
H. rubrum Peter	*H. rubrum* Peter	*H. rubrum* in the Krkonoše Mts. is a stabilized hybrid (*H. aurantiacum* > *H. pilosella*). The same morphological type is known from the Alps, Romania and the Šumava Mts. (Sell & West 1976, Krahulec et al. 2004).

species with no subspecies. This situation changed subsequently and in the second edition of Flora Europaea and some other treatments (Webb 1993, Webb & Gornall 1989), *S. moschata* is considered to be a subspecies of another species, *S. exarata* Villars: *S. exarata* subsp. *moschata* (Wulfen) Cavallier. Webb (1987) considered it to be a subspecies of *S. rosacea*: *S. rosacea* subsp. *moschata*, with no reference to sub-subspecific categories. Even when *S. moschata* is considered to be an independent species, the population from the Krkonoše is only regarded as a variety (Hrouda & Šourková 1992). This suggests that the small population in the Krkonoše is to some degree differentiated. This is not surprising considering the size of the population and its isolation, both in space and time. The question, therefore, is whether the small difference is sufficient reason for the taxonomic separation of particular small populations.

Another group of endemics are apomicts and belong to *Hieracium* subgen. *Hieracium*, *Taraxacum*, *Alchemilla* and *Sorbus*. All belong to obligate apomictic groups and most are so isolated that their endemic status cannot be questioned. Some of the *Hieracium* subgen. *Pilosella*, for example, *Hieracium rubrum*, were also considered to be endemics. Many others, such as those decribed by Schneider (1889–1890), were omitted from the lists. The taxa in this subgenus differ from those in subgen. *Hieracium* and this is reflected in the evaluation of their status. In subgen. *Hieracium*, there is a limited number of genotypes and newly arising genotypes are very rare, if any. In this subgenus, the apomicts behave as full apomicts, with no traces of residual sexuality and hybridization is probably absent, or near to absent. For that reason apomicts have stable lineages. Within the subgen. *Pilosella*, hybridogenous species are relatively common, the species have a high degree of residual sexuality, which results in the formation of not fully isolated lineages. In some morphological types, both apomictic and fully sexual lines occur, as in *H. piloselliflorum* Nägeli et Peter and *H. schultesii* F. W. Schultz (Krahulec et al. 2004). For that reason, it is impossible to classify individual apomictic lines as independent entities, because they are not fully isolated among themselves nor from other species. And, last but not least, many of them are already found in other regions, e.g. *H. rubrum* in the Alps, Eastern Carpathians and the Šumava Mts. In some other genera, e.g. *Sorbus*, hybridogenous taxa with the same parental species are often considered as independent types. However, this approach in subgen. *Pilosella* would produce an unmanageable number of taxa of local importance only.

The alpine types belonging to the *Hieracium* subgen. *Hieracium*, were studied by Zlatník (1938, 1939) and revised recently in a series of papers by J. Chrtek jun. (Chrtek 1997, 2004, Chrtek & Marhold 1998), are mostly clearcut. Some of them do not have endemic status, some have and others are synomized with other species. The species from the groups, that occur at lower altitudes have not been studied recently and their status is questionable. In relation to this group, I consider that the plants occurring above the timberline represent different taxa of the *H. prenanthoides* group. In my opinion, some of them at least will be recognized as endemics in a future revision of these groups on a broader scale.

A particular problem arises in the case of endemics such as *Carex viridula* subsp. *pseudoscandinavica.* It is known from the 1950s and has been studied in detail but not validly published. Nevertheless, the present state of knowledge of this endemic population is relatively extensive.

Euphrasia corcontica was described on the basis of herbarium specimens only; no populations are known to occur in Krkonoše at present. For that reason, an exact evaluation of

this endemic is impossible. Most *Euphrasia* are autogamic (Vitek 1998) and for that reason, especially in the case of some hybridogenous types, they could easily be only short-term evolutionary units.

I have also included *Hieracium tubulosum* and *H. pedunculare* in the list of endemics despite the fact that they were once found also in the Jizerské hory Mts (Bräutigam 2001, Chrtek 2004). Both species were found there at a time of extensive agriculture at higher altitudes. The area of their occurrence is not far from localities in the Krkonoše and both species colonized newly formed localities. After the decline of traditional agricultural management practices both species disappeared. They were evidently introduced or colonized the area in tandem with human activities.

About the same number of endemics are confined to localities in Poland and the Czech Republic. Exclusively "Polish" endemics occur on basalt rocks in Mały Śnieźny Kocioł (Malá Sněžná Jáma, Kleine Schneegrube): *Alchemilla corcontica*, *Pimpinella *rupestris*, *Saxifraga *basaltica*. "Czech" endemics are not so concentrated, they occur at several localities: *Carex *pseudoscandinavica*, *Euphrasia corcontica*, *Knautia *pseudolongifolia*, *Minuartia corcontica* and *Salix lapponum* var. *daphneola*.

With respect to habitat, all endemics are confined to areas above the timberline. Some occur in wind-swept communities on the highest points. Most *Hieracium* species from section *Alpina* belong to this ecological group. *Taraxacum alpestre* occurs in places with a high nutrient content. Some other species of *Hieracium* occur near the timberline or in cirques; taxonomically, they represent transitional types between section *Alpina* and species of lower altitudes. In the case of other species, only one – *Pedicularis sudetica* – occurs on the wet parts of summit plateaus. The other endemics are confined to glacial cirques. They occur in wet places, e.g. *Carex *pseudoscandinavica* as well as in rather dry places, e.g. *Knautia *pseudolongifolia*. The most specialized species with respect to substrate are *Saxifraga *basaltica* and *Pimpinella *rupestris*, which are confined to areas of isolated basalt rock in the Mały Śnieźny Kocioł (Malá Sněžná Jáma) cirque. Of these endemic species, only *Campanula bohemica* has colonized man-made habitats to any great extent, being found especially in artificial grasslands on the Czech side of the mountains and roadside fringes enriched by nutrients. For this reason, *Campanula bohemica* is the only endemic species having many localities at present, but only on the Czech side of the mountains. In Poland it is very rare, because montane meadows are scarce and are not connected to alpine areas. A similar situation occurs with some other non-endemic species, e.g. *Viola lutea* subsp. *sudetica*. Most other endemics are rare, occurring only in a limited number of cirques. In the past, *Alchemilla corcontica* temporarily colonized eutrophicated grasslands on Bílá louka (Weise Wiese) and in the summit area (Plocek 1985, Trávníček 2005). As in the case of *Hieracium tubulosum* and *H. pedunculare*, *A. corcontica* disappeared with changes in agricultural management practices.

Another taxon, *Alchemilla obtusa* subsp. *trapezialis* Plocek, an endemic at lower altitudes in the Western Sudetes, also occurs in the Krkonoše (Kořenov) (Plocek 1995: 269). It is not endemic to the Krkonoše because most of its area of distribution lies outside this mountain range.

The age of these endemics is often discussed. They are considered to be products of population differentiation during the Holocene. This is highly probable for sexual groups, such as *Primula*, *Campanula*, *Pimpinella*, *Knautia*, *Saxifraga* and *Carex*. Sexuality combined with isolation and small population size certainly led to genetic drift and to the evo-

lution of all the endemics of these genera growing in the Krkonoše Mts. The origin of the hybridogenous *Sorbus sudetica* should be contemporaneous with when *S. chamaemespilus* (L.) Crantz and *S. aria* L. Crantz occurred together, probably in early Holocene (cf. Kovanda 1965) or Boreal (Procházka 1999). The case of *Knautia arvensis* subsp. p*seudolongifolia* is also similar. This species is a diploid; at present, diploids occur in Bohemia only in relict habitats, mainly on serpentine and in one locality in the Krkonoše in the cirque of Kotelné jámy. These diploids are considered to be relicts from a warmer period of the Holocene, probably the Boreal (Štěpánek 1989).

The situation of apomictic, especially alpine *Hieracium* taxa, is different. In general, their age is not known because related sexual types currently occur only in the Eastern Carpathians. It is highly probable that they occurred over wide areas at low altitudes during Glacial times. At the end of the last (Weichselian/Würm) glaciation, some of them followed the retreat of the continental glaciers to Northern Europe while others colonized higher altitudes in individual mountain ranges. It was a matter of probability whether they survived or not during the Holocene, when their populations were smaller than at present. It is only in this way that we can explain the existing distribution pattern of individual species. In this regard, the apomictic *Hieracium* species could represent relatively old lineages, certainly older than the Holocene. The same scenario is probable for *Taraxacum alpestre* and *Alchemilla corcontica,* both are alpine species with relatives in other high mountain ranges and in Scandinavia.

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Souhrn

V článku je shrnut současný stav poznatků o endemismu cévnatých rostlin v Krkonoších. Je sestaven seznam taxonů, které jsou považovány v současnosti za endemické a tento seznam je porovnán s předchozími seznamy publikovanými J. Šourkem a E. Hadačem (tab. 1). U taxonů, které byly uvedeny v seznamech těchto autorů a které v současnosti nejsou za endemity považovány, jsou uvedeny důvody k jejich vypuštění, včetně citací originálních prací. Součástí článku je i seznam literatury týkající se jednotlivých endemických taxonů. Stručně je diskutován výskyt endemických typů v Krkonoších; všechny jsou vázány na oblast nad hranicí lesa, včetně výskytu v karech. Pouze druh *Campanula bohemica* má v současnosti mnohem širší rozšíření než v minulosti, protože se vyskytuje na desítkách lokalit na druhotných loukách na české straně pohoří. Některé z endemitů vznikly diferenciací malých populací přímo v Krkonoších během Holocénu. U apomiktických druhů, zejména u rodu *Hieracium*, je daleko pravděpodobnější, že současný endemický character se vztahuje na staré typy rozšířené v během glaciálu v nižších polohách, které v Holocénu ustoupily do vyšších nadmořských výšek a zde přežily do současnosti.

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Appendix 1. – Important papers on endemic species

Alchemilla corcontica Plocek: Plocek 1985, 1995, Pender 2003, Trávníček 2005
Campanula bohemica Hruby: Šourek 1953, Kovanda 1975a, 1977, 2000, Chejnová, Petrás & Krahulec 2000, Krukowski, Kwiatkowski & Potocka 2000, Kwiatkowski 2001, Pender 2003
Carex pallescens var. *alpestris* Čelak.: Kwiatkowski 2000, Pender 2003
Carex viridula Michx. subsp. "*pseudoscandinavica*": Holub 1960, Havlíčková 1983, Holub 1999a, Štursa 1983
Euphrasia corcontica (Smejkal) Smejkal & Dvořáková: Smejkal & Dvořáková 2001
Knautia arvensis subsp. *pseudolongifolia* (Szabó) O. Schwarz: Szabó 1911, Štěpánek 1989, 1997, Štěpánek & Procházka 1999
Minuartia corcontica Dvořáková: Dvořáková 1999
Pedicularis sudetica Willd.: Kavina 1915, Limpricht 1924, Jasiewicz 1963, Kovanda 1975b, Štursa 1986, Hendrych & Hendrychová 1989, Fabiszewski 1993, 2001, Hrouda 2000, Krukowski 1998, 2003, Krukowski, Kwiatkowski & Potocka 2000, Molau & Murray 1996, Štursová & Kociánová 1996, Procházka, Štursová & Kociánová 1999
Pimpinella saxifraga subsp. *rupestris* Weide: Weide 1962, Šourek 1967, Pender 2003.
Primula elatior subsp. *corcontica* (Domin) Kovanda: Kovanda 1997
Saxifraga moschata subsp. *basaltica* Br.-Bl.: Braun-Blanquet 1922, Wójcicki 2001, Pender 2003.
Salix lapponum var. *daphneola* (Tausch) Wimmer: Tausch 1837, Chmelař 1972, Chmelař & Koblížek 1990
Sorbus sudetica (Tausch) Fritsch: Tausch 1834, Jeník 1960, 1979, Kovanda 1965, 1992b, 1998, Štursa 1985, Jankun & Kovanda 1986, Kociánová & Štursová 1986, Procházka 1999, Kociánová, Štursová & Zahradníková 2005
Taraxacum alpestre (Tausch) DC.: Procházka & Štěpánek 1999, Pender 2003

Hieracium alpinum agg.: most of species studied by Zlatník (1938, 1939)
H. melanocephalum Tausch: Chrtek 1997, 2004: 572, Szeląg 2003: 199.
H. tubulosum (Tausch) Tausch: Szeląg 2003: 200, Chrtek 2004: 572, Bräutigam 2001
H. corconticum agg. (*H. nigrescens* < *H. prenanthoides*)
H. asperulum Freyn: Szeląg 2003: 204, Chrtek 2004: 604
H. corconticum Čelak.: Szeląg 2003: 203, Chrtek 2004: 602
H. fritzei agg. (*H. alpinum* > *H. prenanthoides*)
H. fritzei F.W. Schultz: Chrtek & Marhold 1998: 188, Szeląg 2003: 204, Chrtek 2004: 584
H. nigrostylum Zlatn.: Chrtek & Marhold 1998: 201, Szeląg 2003: 205, Chrtek 2004: 586
H. rohlenae Zlatn.: Chrtek & Marhold 1998: 198, Szeląg 2003: 205, Chrtek 2004: 586
H. schneiderianum Zlatn.: Chrtek & Marhold 1998: 194, Szeląg 2003: 205, Chrtek 2004: 585
H. fritzei-saxifragum agg.
H. mariae-bornmuelleriae Zahn: Szeląg 2003
H. glandulosodentatum Uechtr. (*H. lachenalii – H. nigrescens*): Szeląg 2003, Chrtek 2004: 580
H. gombense agg. (*H. epimedium – H. atratum*)
H. purkynei Čelak.: Chrtek 2004: 610
H. nigrescens agg. (*H. alpinum* > *H. murorum*)
H. apiculatum Tausch: Szeląg 2003: 200, Chrtek 2004: 577
H. decipiens Tausch: Szeląg 2003: 201, Chrtek 2004: 576
H. nigrescens Willd.: Szeląg 2003: 201, Chrtek 2004: 575
H. juranum agg. (*H. murorum* < *H. prenanthoides*)
H. pseudalbinum Uechtr.: Szeląg 2003: 207, Chrtek 2004: 588
H. sudeticum agg. (*H. alpinum – H. prenanthoides*) Szeląg 2003: 209
H. pedunculare Uechtr.: Chrtek 2004: 593, Bräutigam 2001
H. alpinum < *H. prenanthoides* agg.
H. riphaeum Uechtr.: Szeląg 2003: 209
H. riphaeum subsp. *micradenophyllum* Zahn: Chrtek 2004: 596
H. umbrosum agg. (*H. murorum* > *H. prenanthoides*)
H. albinum Fries: Procházka & Chrtek 1999, Szeląg 2003, 209, Chrtek 2004: 589
H. saxifragum Fries (*H. lachenalii – H. schmidtii*)
H. saxifragum subsp. *celakovskyanum* Arvet-Touvet: Chrtek 2004: 560