

The distribution of *Cardamine amara* subsp. *opicii* (Cruciferae) in the Sudeten mountains

Rozšíření *Cardamine amara* subsp. *opicii* v Sudetských pohorích

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The distribution of *Cardamine amara* subsp. *opicii* (J. Presl et C. Presl) Čelak. in the Polish and Czech Sudeten mountains is presented. The taxon is relatively widespread in the subalpine belt of the East Sudeten mountains, while in the West Sudeten mountains it is very rare. The historical and recent distribution in the Sudeten phytocorions is discussed, its ecology is briefly commented.

Introduction

The recent results of karyological and morphological studies of the *Cardamine amara* group in the Carpathians and Sudeten mountains (Hrouda 1992, Marhold 1991, 1992) have shown that the populations in this area can be classified in two subspecies - *C. amara* L. subsp. *amara* and *C. amara* subsp. *opicii* (J. Presl et C. Presl) Čelak. (The correct spelling of the epithet is "opicii" not "opizii" as used by many authors - see Marhold et Hrouda 1993). These studies did not confirm the opinion of Habeler (1963) that *C. amara* is a variable species without any possibility of the infraspecific classification. However, some of the discriminative characters, presented in the Floras and keys (e.g. Novák 1948, Dostál 1954, 1958, Nyárády 1955, Jones 1964, Čopyk 1977), namely the number of flowers and length of petals, have no value for the identification of these two subspecies. The aim of the present study is to evaluate the distribution of this taxon in the Sudeten mountains in Czech Republic and Poland on the basis of the materials from the following herbaria (abbreviations according to Holmgren et al. 1990): BRA, BRNM, BRNU, K, LW, OL, PR, PRC, SAV, WRS�, W, WU. The most important literature data are also discussed.

Key to subspecies of *Cardamine amara*

The plants of the *Cardamine amara* group in the Sudeten mountains can be identified using the following key:

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1a Stem branched, with lateral inflorescences	<i>C. amara</i> subsp. <i>amara</i>	2
1b Stem simple, without lateral inflorescences		
2a Stem, rachises of the leaves and pedicels densely hairy	<i>C. amara</i> subsp. <i>opicii</i>	3
2b Stem, rachises of the leaves glabrous or sparsely hairy, pedicels glabrous		
3a The leaves congested under the inflorescence; internodes in the upper part of the stem on average shorter than 5 mm; stem with (10-) 14-25 (-30) leaves; lower leaves with 5-8 pairs of leaflets	<i>C. amara</i> subsp. <i>opicii</i>	
3b The leaves not congested under the inflorescence; internodes in the upper part of the stem on average longer than 10 mm; stem with 5-12 (-20) leaves; lower leaves with 2-4 (-6) pairs of leaflets	<i>C. amara</i> subsp. <i>amara</i>	

Distribution of *Cardamine amara* subsp. *opicii* in the Sudeten mountains

In the following list we considered only the localities documented by the herbarium specimens. Both subspecies of *C. amara*, i.e. *C. amara* subsp. *amara* and *C. amara* subsp. *opicii* were often interchanged, namely the large forms of *C. amara* subsp. *amara* treated under various names (e.g. *C. crassifolia* Opiz) were wrongly attached to *C. amara* subsp. *opicii* (or *C. opicii*). For that reason, it was not possible to consider literature data; however, some of them are discussed later.

C. amara subsp. *opicii* is documented from the rather large number of localities in the Krkonoše Mts. (Karkonosze Mts. in Poland), Mt. Králický Sněžník (Masyw Śnieżnika Mts., Mt. Śnieżnik Kłodzki in Poland) and Hrubý Jeseník Mts., rarely also from the phytogeographical district Orlické hory Mts.. It is interesting that Sychowa in the second edition of Flora Polska (Sychowa 1985) did not mention any localities of this taxon from the Polish Sudeten mountains.

The altitudinal range of both subspecies overlaps. While *C. amara* subsp. *opicii* is concentrated in the supramontane and subalpine belts, *C. amara* subsp. *amara* is concentrated in the submontane and montane belts, but rarely occurs also in the supramontane and subalpine belts. *C. amara* subsp. *opicii* ranges from 750 m (Krkonoše Mts., Dolní dvůr, Kotelný potok; Hrubý Jeseník Mts., Praděd, Divoký důl) to 1390 m (Krkonoše Mts., Luční bouda). The type subspecies in the Krkonoše Mts. reaches 1370 m (Cypers 1895 PR) in the Bílé Labe Valley, while in the Jeseníky Mts., it was found near the cottage Švýčárna, below the main ridge at 1340 m (Šourek et Horák 1953 PR).

List of localities of *Cardamine amara* subsp. *opicii* in the Sudeten mountains in Czech Republic and Poland, documented by the herbarium specimens:

Czech Republic:

93. Krkonoše Mts.

Harrachov - Nový Svět, behind the shingler workshop (Schustler 1910 PR). - Dolní Mísečky, near the stream Jizerka, below the settlement (Soukup 1901 PR). - Mísečky, "Schüsselbaude" (Kavina s.a. PR). - Mísečky, N of the settlement, near the springs on Mt. Krkonoš (Velenovský 1883 PRC; Schustler 1913 PR). - Špindlerův Mlýn, streams near Bedřichov (Kabát 1890 PR). - Bílá louka, W of the cottage Luční bouda (Sitenský s.a. PR). - Luční bouda (Fiek 1875 WRSL, 1881 PRC; Cypers 1879 PR; Beneš 1881 PR; Höger 1881 BRNM, WU; Pax 1881 WRSL). - Mt. Studniční hora, S slope, above the Modrý důl Valley ["Brunnberg", locus classicus] (Opiz s.a. PRC; Kablík s.a. BRNM, BRNU, PR, WRSL, WU; Eisenstein 1818 PRC; Polák 1843 PRC; Pax 1880 WRSL; Wihan 1927 PR; Kavka 1929 BRA; Traxler 1929, 1935 PRC; Šourek 1946 PR; Skřivánek 1948 BRNM; Horák et Šourek 1953 PR; Soják 1954 PR). - Dolní Dvůr, near the stream Kotelný potok, N of the settlement (Cypers 1894 PR, 1899 LW). - Pec pod Sněžkou, in the stream Zelený potok (Šourek 1954 PR). - Pec pod Sněžkou, lower part of the Obří důl Valley, near the Šourek's chalet (Šourková 1946 PR).

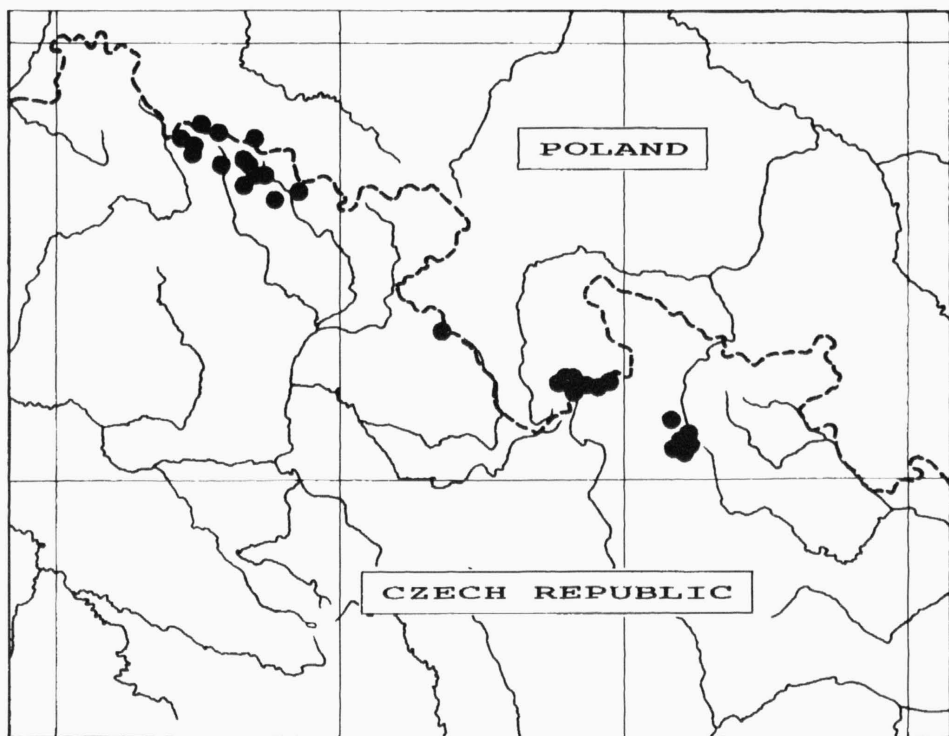


Fig. 1. - Map of the distribution of *Cardamine amara* subsp. *opicii* in the Sudeten mountains.

- Janské lázně, Mt. Černá hora, near the stream below the cottage Černá bouda (Cypers 1904 PR). - Rýchory, springs E of the chalet Rýchorská bouda (Kablik s.a. PR; Hrouda 1979 PR).
Uncertain locality: "Bodenwiese" (Cypers 1895 PR, 1904 PRC).

95. Orlické hory Mts.

"Mensegebirge, Bachufer am Kamme Heustadt" (Freyn 1884 WU).

96. Mt. Králický Sněžník

Mt. Králický Sněžník ["Glatzer Schneeberg", locus classicus] (Opiz s.a. PRC, ut *C. hirsuta*; Müller 1855 WRSL; Oborný 1886 BRNM, 1887 BRNU, WU; Tempský s.a. PRC). - Mt. Králický Sněžník, springs on the S slope (Vicherek 1958 BRNU). - Mt. Králický Sněžník, SW slope, above the saddle between Mt. Králický Sněžník and Mt. Malý Sněžník (Krahulec 1973 PR; Hrouda, Kochjarová et Marhold 1986 PR, SAV). - Mt. Králický Sněžník, the valley of the stream Prudký potok (Krahulec 1973 PR). - Kunčice, Kunčický potok, below Mt. Sivina (Schustler 1919 PR). - Kunčice, Aloisův pramen, below Mt. Sivina (Spitzner 1888 BRNU).

97. Hrubý Jeseník Mts.

Vřesová studánka (Rohrer s.a. PRC; Bittner et Oborný 1880 PRC; Staněk 1919 BRNU). - Mt. Malý Děd, W slopes (Moravec 1947 PR). - Mt. Praděd, "Schonizerweg" (Glacel [herb. Tkanyi] 1847 BRNU). - Mt. Praděd, Divoký důl (Vicherek 1958 BRNU). - Velká kotlina Cirque (s. coll. 1842 W; Reichardt 1854 W; Paul 1876 PRC; Schiffner 1877 WU; Fiek 1880 WRSL; Ficinus 1883 WRSL; Bubela 1884 PRC; J. Šmarda 1920 PR, 1946 BRNM; Weber 1928 PR; Preis 1934 PRC; Laus 1935 WU, 1936 OL, 1937 PR; Leneček 1936 PRC; Skřivánek 1946 BRNM; Deyl 1967 PR). - Velká kotlina Cirque, Šmardova stěna Face (L. et Z. Bureš 1972 OL; Hrouda, Kochjarová et Marhold 1986 PR, SAV). - Mezikotlí Cirque (Bureš et Hrouda 1989 PR). - Malá kotlina Cirque (Bureš et Hrouda 1989 PR).

Poland:

Karkonosze Mts.

Szklarska Poreba, below the cottage Schrona, on the Szrenicka Hala (Winkler 1882 WRSL; Bittner 1886 WRSL; Felsmann 1887 K). - Snieżne Kotły („L.J.P.“ s.a. PR). - Mały Staw (s. coll. 1900 PRC).

Masyw Snieżnika Mts.

Miedzygórze, below Mt. Mały Snieżnik (s. coll. 1853 WRSL). - Mt. Snieżnik Kłodzki, Hala pod Snieżnikiem (Baenitz Herb. Eur. no. 8428, 1895 PR, LW, WU; Staněk 1920 BRNU; Weber 1946 PR; F. Šmarda 1946 BRNM). - Mt. Snieżnik Kłodzki, springs on the NE slope (Vicherek 1958 BRNU).

Remarks on the distribution of *Cardamine amara* subsp. *opicii*

Ciaciura (1988) reports the presence of *C. opicii* among the other localities also from the Góry Izerskie Mts. and Góry Bialskie Mts., but without mentioning exact localities. His work, however, is based not only on his own data and herbarium specimens, but also on the basis of the data from the literature, which could be wrong. The present authors have not seen any herbarium specimens from these mountains. There are no data about this taxon from the Czech part of the Jizerské hory Mts. Some populations of *C. amara* subsp. *amara* from this area, namely that from Malá Jizerská louka, on the N slope of Mt. Bukovec, are somewhat intermediate between both subspecies (especially in the number of stem leaves and the number of their leaflets). Plocek (1986) classified these plants as a local variety, *C. amara* var. *foliolata* Plocek, but in the opinion of the present authors they do not deserve any taxonomic recognition.

Šourek (1969:132) reports *C. amara* subsp. *opicii* from the Krkonoše Mts. also from other localities which are not mentioned in our list. Most of these data are that of Cypers. Some of them are documented in the herbaria, but they actually represent *C. amara* subsp. *amara*. Also Šourek's own specimens are not identified correctly every time; therefore, it is not possible to accept his data from Mt. Žalý and Mumlavský důl Valley in the western part of the Krkonoše Mts. (Šourek 1969:48, 70).

The Freyn's collection represents the only specimen of *C. amara* subsp. *opicii* from the Orlické hory Mts. It was recently found during the revision of the herbarium of Vienna University by the second author and, therefore, it is not mentioned in Květena ČR (Hrouda 1992).

There are several localities from the East Sudeten mountains, mainly from the Hrubý Jeseník Mts. and Mt. Kralický Sněžník. Some other localities published by Fiek (1881) and Laus (1908) from the Hrubý Jeseník Mts. (Mt. Vozka; Karlova Studánka; forester house Vidly) are not documented by any herbarium specimen.

Chorological comments

The present distribution of *C. amara* subsp. *opicii* is somewhat different in the East and West Sudeten mountains. While there are relatively rich localities in the East Sudeten mountains, some of them discovered only recently (e.g. Malá kotlina Cirque), in the Krkonoše Mts. this taxon is very rare. Especially sad is the history of the one of two loci classici, on the slope of Mt. Studniční hora in the Krkonoše Mts. (cf. Marhold et Hrouda 1993). The locality is easily accessible from the tourist path and it was always in the centre of the attention, as it is possible to see from the large number of herbarium specimens. In 1986 there were only a few plants at this locality from which chromosome numbers were counted. The retreat of

C. amara subsp. *opicii* could be due to several reasons. This subspecies was collected not only by botanists but recently also by the collectors of medicinal plants. Besides, the localities in the Krkonoše Mts. were probably never rich. The taxon represents a florogenetically small group of Sudeten-Carpathian plants which are absent in the Alps and rare in the South Carpathians. It probably originated in the (West or East) Carpathians. In the Krkonoše Mts. it reaches the western limit of its occurrence. Such border localities are usually not rich and genetically strong. It is confirmed by the certain trend in some characters in the populations of the Krkonoše Mts. and Jizerské hory Mts. attached to *C. amara* subsp. *amara* (*C. crassifolia* Opiz, *C. amara* var. *foliolata* Plocek).

Some earlier authors (Fiek 1881, Čelakovský 1875) stress the prevalence of glabrous plants (var. *glabra*) in the Krkonoše Mts. and vice versa the prevalence of hairy plants (var. *hirsuta*) in the East Sudeten mountains, and this corresponds with the more recent opinion of Šourek (1969). According to the results of the study of herbarium specimens and living populations these two morphological types often occur together and thus, in the opinion of the present authors, they do not have any taxonomical or chorological significance.

Phytosociology

The centre of the occurrence of this taxon is in springs in the supramontane and subalpine belts, classified as the alliance *Cardamino-Montion* Br.-Bl. 1926 em. Hadač 1983. These are heliophile communities of springs with slightly acid to subneutral water. Within the alliance *Cardamino-Montion* it is most widespread in the associations *Allio sibirici-Cratoneuretum filicini* Jeník, Bureš et Burešová 1980 (Jeník et al. 1983) and *Brachythecio rivularis-Cardaminetum opizii* (Krajina 1933) Hadač 1983 (Hadač 1983). The last association has its centre of distribution in the Carpathians, in the studied area it was published by Šmarda (1950) from the Hučivá Desná Valley in the Hrubý Jeseník Mts. The communities studied at Mt. Kralický Sněžník, also correspond to this association while the communities studied in Malá kotlina and Velká kotlina Cirques can be classified as association *Allio sibirici-Cratoneuretum filicini*. As pointed out by Krahulec (1990), the communities with dominance of *Cardamine amara* subsp. *opicii* are often monospecific, which makes their phytosociological classification difficult.

On the other hand, the type subspecies *C. amara* subsp. *amara* is a diagnostical taxon of spring communities of the alliance *Cardaminion amarae* Maas 1959, concentrated to lower altitudinal belts; in the case that it occurs in higher belts it is confined to the shadow (sciophile) springs (cf. Moravec et al. 1983).

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Summary

Cardamine amara subsp. *opicii* is the Sudeten-Carpathian taxon, occurring in the Sudeten mountains in the Krkonoše Mts. (Karkonosze Mts. in Poland), Mt. Kralický Sněžník (Masyw Snieżnika Mts. in Poland) and in the Hrubý Jeseník Mts.; the specimen, collected at the end of 19th century in the Orlické hory Mts., was recently discovered, but the occurrence of subsp. *opicii* has not been confirmed in the field. This taxon is at present very

rare in the West Sudeten mountains; it is almost extinct in its locus classicus in the Krkonoše Mts. on the slopes of Mt. Studniční hora. On the other hand, it is relatively widespread in the East Sudeten mountains and grows, like in the Carpathians, in the heliophilous spring communities of the alliance *Cardamino-Montion*.

Souhrn

Cardamine amara subsp. *opicii* je sudetsko-karpatský taxon, rozšířený v Sudetech v Krkonoších, na Králickém Sněžníku (v obou pohořích na české i polské straně) a v Hrubém Jeseníku; nově byl objeven též starý doklad z Orlických hor, kde však výskyt není ověřen. V Západních Sudetech je dnes velmi vzácný, téměř zničen byl jeho locus classicus na svazích Studniční hory v Krkonoších. Naproti tomu ve Východních Sudetech se i recentně vyskytuje na více místech dosti hojně. Jeho porosty náležejí, podobně jako naleziště v Karpatech, k heliofilním prameništím společenstvům svazu *Cardamino-Montion*.

References

- Čelakovský L. (1875): Prodnus der Flora von Böhmen. Vol. 3. - Praha.
- Ciaciura M. (1988): Charakterystyka rozmieszczenia górskich gatunków naczyniowych na Śląsku. - Rozpr. Habil. Akad. Med. Wrocław 12:1-157.
- Čopýk V. I. [red.] (1977): Vyznačnyk roslyn Ukrajinskych Karpat. - Naukova dumka, Kijiv.
- Dostál J. (1954): Klíč k úplné květeně ČSR. Ed. 1. - Academia, Praha.
- Dostál J. (1958): Klíč k úplné květeně ČSR. Ed. 2. - Academia, Praha.
- Fiek E. (1881): Flora von Schlesien. - Breslau.
- Habeler E. (1963): Cytotaxonomie von *Cardamine amara* des Alpenostrandes. - Phytom, Horn, 10:161-205.
- Hadač E. (1983): A survey of plant communities of springs and mountain brooks in Czechoslovakia. - Folia Geobot. Phytotax., Praha, 18:339-361.
- Holmgren P. K., Holmgren N. H. et Barnett L. C. (1990): Index herbariorum. Part I: The herbaria of the world. Ed. 8. - New York Botanical Garden, Bronx.
- Hrouda L. (1992): 18. *Cardamine* L. - řeřišnice [excl. *C. pratensis* agg.]. - In: Hejný S. et Slavík B. [red.]: Květena České republiky 3:92, 93, 98-110, Academia, Praha.
- Jeník J., Bureš L. et Burešová Z. (1983): Revised flora of Velká Kotlina Cirque, the Sudeten Mountains, I. - Preslia, Praha, 55:25-61.
- Jones B. M. G. (1964): 41. *Cardamine* L. - In: Tutin T. G. et al. [red.]: Flora Europaea 1:285-289, University Press, Cambridge.
- Krahulec F. (1990): Alpine vegetation of the Kralický Sněžník Mts. (The Sudeten Mts.). - Preslia, Praha, 62:307-322.
- Laus H. (1908): Schulflora der Sudetenländer. - Brünn.
- Marhold K. (1991): *Cardamine amara* L. in the Slovakian and Polish Carpathians. - Veröff. Geobot. Inst. ETH Stif. Rübel Zürich 106:273-281.
- Marhold K. (1992): A multivariate morphometric study of the *Cardamine amara* group (*Cruciferae*) in the Carpathian and Sudeten mountains. - Bot. J. Linn. Soc., London, 110:121-135.
- Marhold K. et Hrouda L. (1993): Lectotypification of *Cardamine amara* subsp. *opicii* (J. Presl & C. Presl) Čelak. (*Brassicaceae*). - Taxon, Berlin, 42:101-102.
- Moravec J. et al. (1983): Rostlinná společenstva České socialistické republiky a jejich ohrožení. - Severočas. Přir., Litoměřice, 1983/Append. 1: 1-110.
- Novák F. A. (1948): Rod 125. *Cardamine* L. em. Cr. - In: Dostál J., Květena ČSR, p. 286-293, Praha.
- Nyárády E. I. (1955): Genul 157. *Cardamine* L. - In: Savulescu T. [red.]: Flora Republicii populare Romane 3:255-275, Editura Academiei RPR, Bucuresti.
- Plocek A. (1986): Květena Jizerských hor. 4. *Balsaminaceae* až *Cyperaceae*. - Sborn. Severočas. Muz.-Přir. Vědy, Liberec, 15:5-52.
- Šmarda J. (1950): Květena Hrubého Jeseníku. - Čas. Morav. Muz., Brno, 35: 3-81.
- Šourek J. (1969): Květena Krkonoš. - Academia, Praha.
- Sychowa M. (1985): 16. *Cardamine* L., Rzezucha. - In: Jasiewicz A. [red.]: Flora Polska, ed. 2, 4: 192-200, Warszawa et Kraków.

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