Cardamine dentata (Brassicaceae) in Poland

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ABSTRACT: The results of taxonomic studies of Cardamine dentata Schult. from Poland are presented and the distribution map of the species in Poland based on a revision of herbarium material is provided for the first time. The problem of hybridization of C. dentata is briefly discussed.

KEY WORDS: Brassicaceae, Cardamine dentata, taxonomy, distribution map, hybridization, Poland

INTRODUCTION

The genus Cardamine L. contains about 200 species, including approximately 17 species often treated as a separate genus Dentaria L. but not forming a monophyletic group (Al-Shehbaz 1988; Franzke et al. 1998; Sweeney & Price 2000). The genus is cosmopolitan, with representatives on all continents except Antarctica. In Poland the genus Cardamine is represented by 12 species, including those previously classified in the genus Dentaria.

Cardamine dentata Schult. for a long time has been treated as one of the subspecific taxa of the broadly conceived species C. pratensis L., including both editions of Flora of Poland (Kulczyński 1927; Sychowa 1985). However, the C. pratensis group is a rather complicated polyploid complex; it includes taxa on diploid to dodecaploid (or even higher) levels (including high polyploid C. dentata) which are better to treat as separate species (Marhold 1994a and literature; Wójcicki 1995).

The results presented here are based on a critical revision of herbarium material housed at the following herbaria: BIL, GDMA, GE, GLM, KRA, KRAM, KTU, LBL, LOD, LW, OLS, POZ, TRN, UGDA, WA, WRSL (abbreviations according to Holmgren et al. 1990 and Mirek et al. 1997).

The distribution of C. dentata in Poland is presented in the ATPOL grid square system (Zając 1978).
**TAXONOMIC HISTORY**

Schultes (1809) considered the presence of stolons and cauline leaves with petiolate and dentate leaflets as characters distinguishing *Cardamine dentata* from *C. pratensis* (“Stolonifera, foliis pinnatis, foliolis radicalibus subrotundis, angulato-carnosulis, caulinis oblongis, subsinuato-dentatis, petiolatis, extimo majore subtridentato ...”). The petiolate leaflets of all (including the uppermost) cauline leaves indeed represent the most striking diagnostic feature of the species, but the former character was often a source of confusion. It is very likely that Schultes misinterpreted the leaves of the basal rosette, which sometimes root at the bases of leaflets for stolons. There are many cases of misinterpretation of this taxon in old but also recent literature. For example, Reichenbach (1830–1832, 1837–1838), Koch (1835), Neilreich (1859) and at least partly also Kulczyński (1927) placed under the name *C. dentata* (or its subspecific equivalent) plants possessing rosette leaves with dentate leaflets, now considered to represent *C. pratensis* s. str.; Assenov (1970) classified as *C. palustris* Peterm. (with the name *C. dentata* given as synonym) plants from the coast of the Black Sea in Bulgaria, currently treated as *C. penzesii* Ančev & Marhold (Marhold & Ančev 1999). Probably an incorrect interpretation of Schultes’ species name is what has caused the same taxon to be described under different names by various authors (Knaf 1846; Petermann 1846; Hallier 1866). For example, in 1846 Petermann described *C. palustris* and included not only plants with dentate leaflets of stem leaves but also plants with entire leaflets. His morphological concept of *C. palustris* was slightly broader than that of Schultes’ *C. dentata*.

Later Lökvist (1956) considered the name *C. dentata* to be confusing, and instead adopted *C. palustris* Peterm. as the correct name for this taxon; this has influenced many authors including Jones (1964). On the other hand, Lökvist (1956, 1958) was the first author to recognize correctly that this taxon represents a complex of octoploid to dodecaploid populations often forming hybrid swarms, and thus representing a true biological species.

**DESCRIPTION**

*Cardamine dentata* Schult. (Fig. 1)

Observ. Bot.: 126, 1809.


Perennial herb, (20–)30–50 cm tall. Rhizome short, simple. Stem erect, usually simple, sometimes slightly flexuose, glabrous. Leaves pinnate. Rosette leaves mostly glabrous, immature leaves with appressed or rarely patent hairs, pinnate, with 3–12 pairs of petiolate, circular or broadly ovate, rarely obovate, deciduous lateral leaflets; terminal leaflet much larger than lateral ones, reniform to truncate at base, entire or ± sinuate. Cauline leaves 5–12, glabrous, pinnate, lower cauline leaves with 3–10 pairs of leaflets, leaflets distinctly petiolate, often deciduous, elliptic, obovate to linear, entire or irregularly serrate to sinuate. Inflorescence racemose; sepals 4.5–6.0 mm long, margin membranous; petals
white to pale reddish-violet, obovate, (9.0–12.0–16.0–19.0) mm long and 7.0–11.0 mm wide; stamens 6, anthers yellow before anthesis, filaments of longer stamens 4.5–8.5 mm long, filaments of shorter stamens 2.5–5.5 mm long; stigma conspicuous, enlarged. Pedicels patent or erect-patent, siliques divergent from axis at the same angle as pedicels or erect, (20–30–50 mm long and 1.1–1.5–2.0 mm wide. Flowering V (VI).

The position of the hairs on the rachis of the youngest leaves of the basal rosette and on those arising from adventitious buds is usually characteristic for the given species of the C. pratensis group. Those hairs are appressed on the plants of C. rivularis Schur, C. matthioli Moretti and C. penzesii Marhold & Ančev, and patent on C. pratensis (s. str.), C. crassifolia Pourn., and C. granulosa All. Cardamine dentata, however, represents an exceptional case in which both appressed and patent hairs on the leaves can be found. This may be a result of either introgression or the complicated origin of this high polyploid and variable species.

**CHROMOSOME NUMBERS**

*Cardamine dentata* is a high polyploid taxon with reported chromosome numbers from 56 to ca 113 (cf. Jalas & Suominen 1994). This range of numbers includes not only polyploids but also dysploids and aneuploids. The most comprehensive study of the chromosome numbers of this species and the hybridization of its different chromosome races was done by Lökvist (1956, 1958). He concluded that no sterility barrier is met between the octoploids and higher polyploids within *C. dentata*, and that this fact together with the morphological evidence makes it necessary to treat the whole aggregate as one very widely defined species. For the spreading of plants with various aneuploid chromosome numbers, vegetative propagation of *C. dentata* by adventitious buds arising on leaves of the basal rosette and on the cauline leaves and their axils most probably plays the crucial role.

The only chromosome numbers reported for *C. dentata* from Poland so far are those from Banach (1951). She concluded that plants of *C. pratensis* var. *pratensis* are characterized by chromosome numbers $2n = 30, 32, 38, 44, 50, 58, 64$, while those of *C. pratensis* var. *dentata* possess $2n = 68, 72, 76$ and 78. This is in line with data from other parts of the distribution area of the species, except that plants with $2n = 64$ chromosomes usually show morphological features of *C. dentata* (e.g., Murín & Feráková 1976; Marhold 1984, 1994b for Slovakia). Unfortunately the voucher material studied by Banach (1951) could not be reexamined as it was not available during the present study.

**HYBRIDIZATION**

Rohlena (1925) was the first author to report a hybrid between *Cardamine pratensis* and *C. dentata* using the formula for the hybrid, but without a description. Domin (1935) introduced binominal name *C. ×rohlenae*, but it should also be treated as a *nomen invalidum* as it was not accompanied by a description [see Art. H.10.1 of the ICBN (Greuter *et al.* 2000)]. Original herbarium material for this name probably does not exist. There are
some herbarium sheets housed in PRC from the *locus classicus* of the hybrid collected by Rohlena, but they represent only parent species.

From the morphology of some of the specimens investigated and from study of populations in the field it is certain that *C. pratensis* and *C. dentata* produce hybrids quite frequently. In most cases such plants are characterized by intermediate-size petals usually pale violet-reddish, and leaflets slightly petiolate. In many cases, however, it is difficult to say whether a specimen is an introgressive form or rather falls within the large range of variability of the parent species, especially when it is closer to *C. pratensis*. It is not easy to characterize this hybrid karyologically because of the different ploidy levels found in both parent species (*C. pratensis* and *C. dentata*). Tomšovic (1992) reported chromosome numbers $2n = 60$ and 72 for the hybrid from the area of the Czech Republic, adding that this hybrid is “hard to define in spite of the fact that its presence in natural populations is obvious.”

**GENERAL DISTRIBUTION**

*Cardamine dentata* occurs in Central and Northwestern Europe, to the north of the river Po and the Danube Basin; it extends eastward to Siberia, the Far East, the Kamchatka Peninsula and the Kuril Islands. It is also reported from North America, but the status of American plants attributed to *C. dentata* is still to be settled. Data from areas to the south of the Danube River (e.g., from Bulgaria by Assenov 1970) are based on misidentifications of other taxa.

**DISTRIBUTION IN POLAND**

Kulczyński (1927) reported “*C. pratensis* var. *dentata* Schult.” as widely distributed for the lowland area of Poland; however, this statement is at least partly based on a misinterpretation of this name. Sychowa (1985) reported a taxon corresponding to *C. dentata* as *C. pratensis* subsp. *palustris* (Wimm. & Grab.) Janch., and although her concept of this taxon corresponded well with the present one morphologically, she did not provide any exact distribution data, only a general statement that this subspecies occurs in the same localities as the type subspecies but in different ecological conditions, namely places with a higher water level.

Recently, in a taxonomic account of the *Cardamine pratensis* group in the Carpathians and Pannonia, Marhold (1994a) reported the occurrence of *C. dentata* for the Polish Carpathians in Pogórze Wielickie (Skawina), Beskid Makowski (Kalwaria Zebrzydowska) and Pogórze Rożnowskie (Zglobice). However, on the map of this taxon published in the same year in *Atlas floriae europaeae* (Jalas & Suominen 1994, as *C. pratensis* subsp. *paludosa*) no distribution data are indicated for Poland except for the grid squares bordering with neighboring countries. This is apparently the result of a misinterpretation of this name by the local contributors to this composite work.
The first distribution map of *C. dentata* in Poland made on the basis of revised herbarium material, presented here (Fig. 2) indicates that it is a truly lowland species widely scattered throughout the country, with a vertical limit at about 400 m a.s.l. The map fills a gap in knowledge of the distribution of this species in Europe.

The species shows rather narrow ecological tolerance, and in particular wet habitat requirements. According to information from the herbarium labels and our own observations in Poland, *C. dentata* usually grows in communities of the *Alnion glutinosae* and *Alno-Padion* alliances as well as of the *Phragmitetalia*, *Magnocaricetalia* and *Molinieta-lia* orders. Rarely it also occurs on peat bogs and flush associations of the *Montio-Cardaminetalia* order.

As there are fewer and fewer periodically very wet habitats in Poland suitable for *C. dentata*, it is very probable that in many localities the species gradually is being...
replaced by hybrid and introgressive forms very close in morphology to *C. pratensis* s. str. In Poland *C. dentata* should probably be seen as a species endangered by human activity.

Cardamine dentata *localities in Poland* (Fig. 2)

**GRID SQUARE AB:** 93 – Szczecin, 06 May 1959, *leg. E. Ćwikliński* (LOD).


**GRID SQUARE AE:** 06 – Rusków near Zgorzelec, 10 July 1888, *leg. J. Macker* (WRSL);


**GRID SQUARE BE:** 13 – Lubin, 16 May 1902, *leg. J. Matzker* (WRSL); 17 – Ligota Strupińska near Wołów, 28 May 1893, *leg. T. Schube* (WRSL); 35 – Prawików, ?, *leg. H. Żarczyńska* (WRSL);


**GRID SQUARE CD:** 09 – Sompolno, 08 May 1963, *leg. Z. Mikołajczyk* (LOD); Zakrzówek near


GRID SQUARE CF: 13 – Korfantów, 1 June 1906, leg. Bächs (WRSL); 56 – Racibórz, ?, leg. ?. Kelch (GLM).


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GRID SQUARE EE: 00 – Tomaszów Maz, ? June 1960, leg. E. Zalewska & E. Woźniak (LOD);


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