

# Chromosome numbers of the *Cardamine pratensis* group in Austria with taxonomic remarks

By

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**Abstract:** *C. pratensis* L. (= *C. rivularis* auct. non Schur) –  $2n = 16, 32$ ; *C. matthioli* Moretti –  $2n = 16, 18$ ; and *C. majovskii* Marhold & Záborský (1986) –  $2n = 32$ . The mountain populations traditionally called “*C. rivularis* Schur” or “*C. crassifolia* Pourr.” are markedly different from both these taxa. They are preliminarily referred here to *C. pratensis* L., as no clear morphological differences against this species have been found. There seem to be also no morphological differences between the diploids (only on mt. Koralpe) and the widely distributed tetraploids. An identification key enabling differentiation of *C. matthioli* and *C. majovskii* is added. The latter species is confirmed, by the chromosome counts, to grow also in Austria (S. Burgenland).

Deutsche Zusammenfassung am Ende (S. 4), unmittelbar vor dem Literaturverzeichnis!

## 1 Introduction

In connection with the preparation of the account of the genus *Cardamine* for the Flora of Austria, chromosome numbers of three taxa of the *Cardamine pratensis* group, namely *C. pratensis* L., *C. matthioli* Moretti and *C. majovskii* Marhold & Záborský, were counted. The group of species studied is extremely variable with respect to chromosome numbers and throughout the total range it includes diploids, polyploids, dysploids as well as aneuploids (LÖVKVIST 1956, URBANSKA-WORYTKIEWICZ & LANDOLT 1974, MARHOLD 1994a).

## 2 Material and methods

Chromosome numbers were counted using mitotic root-tip divisions in plants taken from the wild and cultivated at the Institute of Botany of the Slovak Academy of Sciences in Bratislava. The roots were pretreated with 0.002 M aqueous solution of hydroxyquinoline for 3 hrs, then fixed for 10 min. to 24 hrs in a freshly prepared mixture of ethanol and acetic acid (3 : 1), hydrolysed for 5 min. in a mixture of hydrochloric acid and ethanol (1 : 1), washed in water, and then stained with acetic or propionic orcein. Temporary slides were made by the squash method. Voucher specimens are deposited in herbarium SAV

The taxonomy follows MARHOLD (1994a, 1996). – K. M. = Karol Marhold.

## 3 Chromosome numbers and taxonomic remarks

### 3.1 *Cardamine pratensis* (= *C. pratensis* subsp. *pratensis*)

Steiermark: Koralpe, Großer Speikkogel, above the Speiksee Lake; 1900 m s. m.; (9255/2); 29.7.1991: leg. K. M. –  $2n = 16$ .

–: Niedere Tauern: Schladminger Tauern, Sölkerpass, above the Unterer Kaltenbachsee; 1820 m s. m.; (8750/1); 4.7.1993: leg. K. M. & W. Rehak. –  $2n = 32$ .

Seckauer Alpen, Gotstalbach (N of Seckauer Zinken), Gotstalkessel; 1640–1825 m s. m.; (8654/1); 3.7.1993: leg. K. M. & W. Rehak. –  $2n = 32$ .

–: nördliche Wölzer Tauern, near the lake S of Plannerknot; 1830 m s. m.; (8551/3); 4.7.1993: leg. K. M. & W. Rehak. –  $2n = 32$ .

Kärnten: Gurktaler Alpen: Nockberge, SW of the Falkertsee; 1940 m s. m. (9148/2); 6.7.1993: leg. K. M. & W. Rehak. –  $2n = 32$ .

–: –, SE of the Schnee grubensattel; 1650 m s. m.; (9048/4); 6.7.1993: leg. K. M. & W. Rehak. –  $2n = 32$ .

–: Flattnitz, below the Zelinsee Lake; 1840 m s. m.; (9049/4); 5.7.1993: leg. K. M. & W. Rehak. –  $2n = 32$ .

It has already been shown (MARHOLD 1995) that the mountain chromosome races of *Cardamine pratensis* from the Eastern Alps, traditionally called “*C. rivularis* Schur” or “*C. crassifolia* Pourr.” are markedly different from both these taxa. While *C. crassifolia*, endemic to the Pyrenees, is characterised by an ascending stem and long rhizomes, *C. rivularis*, occurring in south Roumania and Bulgaria, has appressed hairs on the rosette leaves and violet anthers, characters which are absent in the populations of the Eastern Alps (MARHOLD & RAYNER 1994, MARHOLD 1995). In the absence of any reliable differential characters, the mountain races in the Eastern Alps should be preliminarily referred to *C. pratensis* L. s. str. It is important to note that, while tetraploids with  $2n = 32$  are relatively widespread in the high altitudes of the Eastern Alps, diploids are known only from one locality on mt. Koralpe (LÖVKVIST 1956, TEPPNER 1980) – a distribution pattern connected with pleistocene paleogeography, known from several other cases (cf. also TEPPNER 1980). So far, no morphological differences between these two karyotypes have been found. It remains to be confirmed if the diploid plants ( $2n = 16$ ) reported by URBANSKA-WORYTKIEWICZ & LANDOLT (1974) from much lower altitudes (650–1100 m) in the Tyrol are genetically close to the plants from mt. Koralpe or not. Other high mountain relatives of these populations are those from the subalpine and alpine belt of the Eastern Carpathians (MARHOLD 1994a, 1996). They are diploid ( $2n = 16$ ) and currently also provisionally referred to *C. pratensis* s. str.

### 3.2 *Cardamine matthioli* (= *Cardamine pratensis* subsp. *matthioli* (Moretti) Nyman)

Steiermark Ost-Steiermark: Pischelsdorf, in the village; ca. 350 m s. m.; (8860/2); 2.5.1994: leg. K. M., W. Gutermann & E. Hörndl. –  $2n = 16$ .

–: Pöllauberg (near Hartberg), just near the church; 730 m s. m.; (8661/4); 2.5.1994: leg. K. M., W. Gutermann & E. Hörndl. –  $2n = 16$ .

--: Maxendorf (NE of Kirchbach i. Steiermark), 0,5 km NE of the church; 360 m s. m.; (9060/1); 1.5.1994: leg. K. M., W. Gutermann & E. Hörandl. – 2n = 16.

Riegersburg, near the fishpond; ca. 300 m s. m.; (8961/4); 1.5.1994: leg. K. M., W. Gutermann & E. Hörandl. – 2n = 16.

between the villages of Haag and Waldsberg (S of Merkendorf and Feldbach); 260 m s. m.; (9161/3); 1.5.1994: leg. K. M., W. Gutermann & E. Hörandl. – 2n = 16, 18.

Großpesendorf (NE of Gleisdorf), near the rivulet Ilzbach; 335 m s. m.; (8860/2); 2.5.1994: leg. K. M., W. Gutermann & E. Hörandl. – 2n = 16.

NW of Feldbach, near the village of Auersbach; 285 m s. m.; (9061/1); 1.5.1994: leg. K. M., W. Gutermann & E. Hörandl. – 2n = 16.

Burgenland: Süd-Burgenland: S of Wolfau (SW of Oberwart), Stögersbach; 320 m s. m.; (8762/4); 30.4.1994: leg. K. M., W. Gutermann & E. Hörandl. – 2n = 16.

--: Moschendorf, meadow on the edge of the Moschendorfer Wald (ENE of the village of Strem); 220 m s. m.; (8964/4); 1.5.1994: leg. K. M., W. Gutermann & E. Hörandl. – 2n = 16.

Kroisegg (6 km W of Pinkafeld); 440 m s. m.; (8662/2); 30.4.1994: leg. K. M., W. Gutermann & E. Hörandl. – 2n = 16.

These counts confirm the previously reported diploid number known from Lower Austria (LÖVKVIST 1956, MARHOLD 1994a) and from other parts of the range of this species. The aneuploid chromosome number,  $2n = 18$ , is reported for the first time for Austria, but this number is already known from the Czech Republic (JAVŮRKOVÁ 1986), Slovakia, Ukraine (MARHOLD 1994a), and Hungary (MARHOLD 1991). Only euploid plants are known in the most western part of the range of this species (Switzerland, Italy) (URBANSKA-WORYTKIEWICZ & LANDOLT 1974).

### 3.3 *Cardamine majovskii* (Marhold & Záborský 1986, Preslia 58: 194–196)

Burgenland: Süd-Bgd: Mogersdorf, between St. Anna Chapel and the railway station, 230 m s. m.; (9063/3); 1.5.1994: leg. K. M., W. Gutermann & E. Hörandl. – 2n = 32.

--: NW of Güssing, between the villages of Gamschdorf and Schalendorf, 230 m s. m.; (8863/4); 30.4.1994: leg. K. M., W. Gutermann & E. Hörandl. – 2n = 32.

Unterschützen (N of Oberwart), W margin of the village, 330 m s. m.; (8663/3); 30.4.1994: leg. K. M., W. Gutermann & E. Hörandl. – 2n = 32.

These counts confirm the occurrence of the tetraploid *C. majovskii* for the area of SE. Austria which was already expected (MARHOLD in ADLER & al. 1994: 594). The distribution range currently known of this species includes Eastern Slovakia, Transcarpathian Ukraine, Roumania, NE. and SW Hungary and Slovenia (cf. MARHOLD 1994b). Still, there are no data yet for the area of Styria, but *C. majovskii* can be expected there because of the already confirmed occurrence of this taxon at several places in neighbouring Slovenia (DRUŠKOVIČ & LOVKA 1995: 16, as *C. matthioli*,  $2n = 32$ ; MARHOLD, unpubl.). The chromosome number report by GADELLA & al. (1970: 190) ( $2n = 32$ ), for *C. pratensis* from Burgenland (Güssing), should be most probably referred to this taxon as well (although it was not possible to trace the voucher specimen for this count in the herbarium of the University of Utrecht).

Morphologically, *C. majovskii* closely resembles *C. matthioli* (by the shape of the stem leaves, by having the upper segments of the stem leaves spreading horizontally and the lower ones slightly deflexed, by the appressed hairs on the rosette leaves, and by the white or pale violet petals), but it differs by the size of the flower parts, especially the petals, and pollen grains (MARHOLD 1996). Previous morphometric studies showed that by using the size of petals more than 85% plants of *C. matthioli* and *C. majovskii* can be correctly classified, while using the size of pollen grains the correctness of the classification is more than 97%. The following key can be used for their identification (MARHOLD 1996):

- |   |                                                                                                          |                     |
|---|----------------------------------------------------------------------------------------------------------|---------------------|
| 1 | Petals 5.0–9.0(–12.0) mm long and 2.5–5.5(–6.0) mm wide, average pollen grain diameter 24.0–27.8 $\mu$ m | <i>C. matthioli</i> |
| – | Petals 8.5–16.5 mm long and (5.0–)5.5–12.0 mm wide, average pollen grain diameter 28.3–32.3 $\mu$ m      | <i>C. majovskii</i> |

It is worth mentioning that the appressed hairs on the young rosette leaves represent the most reliable distinguishing character of both *C. matthioli* and *C. majovskii* from *C. pratensis* s. str. (including *C. "rivularis"* auct. non Schur from the Eastern Alps) which has patent hairs. *Cardamine matthioli* and *C. majovskii* share this character with those taxa restricted (or almost restricted) to the Balkan Peninsula, i. e. diploid *C. rivularis* Schur and *C. penzesii* Anč & Marhold (MARHOLD & ANČEV, in prep.). This character also appears in some populations of *C. dentata* Schult. (= *C. palustris* Pe-term.), probably mainly in its southern part of the distribution area.

#### 4 Zusammenfassung

##### Chromosomenzahlen aus der *Cardamine pratensis*-Gruppe in Österreich mit taxonomischen Anmerkungen.

Die in der österreichischen Floristik „*C. rivularis* Schur“ (EHRENDORFER 1973) oder „*C. pratensis* subsp. *rivularis* (Schur) Janchen“ (JANCHEN 1958) genannten (subalpinen bis alpinen) Hochgebirgspopulationen unterscheiden sich sehr deutlich von jenem Taxon Süd-Rumäniens und Bulgariens, das zu Recht so zu bezeichnen ist. Dies geht auch schon aus MARHOLD (1993) hervor und ist auch in der „Exkursionsflora“ ADLER & al. (1994: 594) angedeutet. Die – u. a. in eben diesem Buch und in dieser Stelle angeführten – Unterscheidungsmerkmale (Pkt 13– u. 14) sind vermutlich nicht ausreichend verlässlich, um jene Hochgebirgssassen zu erfassen und von den („typischen“) Tieflandsrassen der *C. pratensis* zu unterscheiden. 6 Populationen in den Niederen Tauern (Steiermark) und in den Gurktaler Alpen (Kärnten) erwiesen sich als tetraploid ( $2n = 32$ ); eine auf der Koralpe jedoch als diploid ( $2n = 16$ ); diese beiden Karyotypen unterscheiden sich morphologisch anscheinend nicht voneinander. – An 7 steirischen und 3 burgenländischen Populationen von *C. matthioli* wurde die diploide Chromosomenzahl  $2n = 16$  bestätigt, an einer Population wurde erstmals für Österreich die aneuploide Zahl  $2n = 18$  festgestellt. – Die Vermutung, dass die aus der Ost-Slowakei, der transkarpatischen Ukraine, Rumänien, Ungarn und Slowenien bekannte tetraploide *C. majovskii* auch im südöstlichen Österreich vorkommt (MARHOLD in ADLER & al. 1994: 594), wurde für das Südburgenland (3 Fundorte) bestätigt. Sie unterscheidet sich von *C. matthioli* durch die längeren (8,5–16,5 mm) und breiteren (meist 5,5–12 mm) Kronblätter und die größeren Pollenkörner (28,3–32,3  $\mu$ m Ø).

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