

Nomenclature problems and species delimitation

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been followed there.

As far as other parts of the Alps are concerned, some plants were sent to us from surroundings of Salzburg and from Oberösterreich; they represented higher polyploid levels and therefore are not included in the present paper. It should be noted, however, that LÖVKVIST (1956) has previously dealt with some diploid taxa from the region of Vienna and from Styria. The Swedish author has also studied an ample material of *C. pratensis* s.l. from various parts of its area of distribution.

Southwestern Alps are not represented in our collections. According to the bibliographic data, the *C. pratensis* complex is there either extremely scarce or totally absent.

Not only living plants, but also an ample herbarium material was studied in the course of the present work; numerous specimens were tested for the pollen quality. The following collections were obtained on loan;

Austria: Graz (GZU), Innsbruck (IB,IBF), Klagenfurt (KL), Linz (LI)

France: Grenoble (GR)

Germany: Munich (M)

Italy: Florence (FI), Genoa (GE), Padua (PAD), Pavia (PAV), Verona (VER)

Switzerland: Berne (BERN), Geneva (G), Lausanne (LAU), Lugano, Zurich (Z, ZT,RUEB)

Yugoslavia: Ljubliana (LJU)

As far as some herbarium collections from Vienna (W, WU) and those from Turin (T) are concerned, we refer to the data of LÖVKVIST (1956).

Figures in the description of the taxa are based upon a combination of data from measurements of the herbarium material collected in natural conditions and those of the cultivated plants. Maps and lists comprise as well the data obtained from the loan specimens.

The methods used in cytological investigations as well as technical details concerning the experimental crosses are given in the respective chapters.

3. Nomenclature problems and species delimitation

Six taxa have been distinguished among the diploids occurring within the studied area: *Cardamine granulosa*, *C. Matthioli*, *C. udicola*, *C. rivularis*, *C. pratensis* and *C. nemorosa*. *C. udicola*, very rare and particularly isolated in its geographical distribution, was but partly investigated in the

course of the present work.

The nomenclature used in the present paper corresponds in general to that previously accepted by LÖVKVIST (1956). However, LÖVKVIST has not distinguished *C. udicola* from other taxa; furthermore, he has considered *C. nemorosa* only as a variety and has used the name of *C. pratensis* in a more general sense than do the present authors.

In *Cardamine pratensis* s.l., as in any other critical biological complex, the delimitation of taxa is to a certain extent arbitrary. The authors are fully aware of the fact that a definite taxonomical status of actually presented taxa still remains an open question. Only after having completed biosystematic study on the whole group, including all polyploid levels, a more reliable revision can be done. For practical purposes, however, provisional specific names were presently given to the resp. diploid taxa and we intend to follow them in further course of the investigations.

The name of *Cardamine granulosa* All. has appeared for the first time in 1789 in "Auctarium ad Floram Pedemontanam". The described specimens originated from the surroundings of Turin. The plants studied in the course of the present work correspond well to this original diagnosis.

Cardamine Matthioli Moretti has been described in 1847 in "Flora Comense" by COMOLLI, who distinguished this species from *C. pratensis* and referred to a very precise diagnosis by MORETTI: "Caule caespitoso ramoso; racemo composito, floribus albis". COMOLLI mentioned very small seeds occurring in *C. Matthioli* ("Semi piccolissimi"). The diagnosis of *Cardamine Matthioli* based on the data of MORETTI and COMOLLI seems to be univocal. It should be added that a name of *C. Hayneana* Welwitsch, previously reported as a synonyme for *C. Matthioli*, has been published without description and hence is not valid (see LÖVKVIST 1956).

Cardamine udicola Jord. has been described in 1860; the diagnosis of JORDAN has been based upon material from the region of Lyon, France. The plants found by the present authors in the surroundings of the Lake of Thun as well as in southern Ticino correspond rather well to the original description; however, we have not seen the type specimen.

Cardamine nemorosa Lejeune has been described in 1813 from the surroundings of Spa, Belgium. LÖVKVIST (1956) assumed that this name corresponded to the diploid plants of the forest type. However, during our field-work in the surroundings of Spa tetraploid plants have solely been found.

Nevertheless one might assume that the diploids remain to be found in this region.

Cardamine pratensis L. appeared for the first time in "Species Plantarum" (1753). The diagnosis of LINNEUS was probably based on tetraploid plants occurring frequently in meadows of southern Sweden. As far as the morphology of *C. pratensis* is concerned, it is virtually impossible to distinguish the plants which grow in fertilized meadows of Central Europe north of the Alps from those occurring in Sweden; the name of *C. pratensis* should be used accordingly for all various cytotypes, including the diploid one investigated in the course of the present work.

Cardamine rivularis Schur has been described in 1853 from Mt. Arpas in Transsilvania. The original specimens of SCHUR, kindly sent to us by Prof. Dr. K.H. RECHINGER (Museum of the Natural History, Vienna), represented various pollen types; it might be assumed that they comprised diploids, tetraploids as well as some hybrid individuals. Our representatives of *C. rivularis* are identical with the putative diploid herbarium specimens of SCHUR.

4. Morphology

4.1. Morphological variation and diagnostic characters

The variation pattern of the *Cardamine pratensis* group is intrinsically complex; phenotypic modifications as well as polymorphism and racial variation contribute to the taxonomic difficulty of studied diploids. Total range of genotypically and environmentally induced variation is large. Even where morphological distinctions between taxa are rather well-marked, the ranges of variation may overlap and some phenotypes of one taxon may mimic certain phenotypes of another taxon (e.g. *C. nemorosa* - *C. pratensis*). This creates difficulties for determination of herbarium specimens which do not show the whole range of variation within the population. An accurate identification may sometimes be virtually impossible in the herbarium, given an inadequate series.

Some amount of racial variation from population to population is not practicable to recognize taxonomically. On the other hand, some races which grow in isolated habitats are separated by a certain degree of morphological discontinuity from their relatives (e.g. *C. Matthioli*, *C. udi-*