

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

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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 (Zajac 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 Peterman 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 Lövkvist (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, Lövkvist (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.

≡ *Cardamine pratensis* var. *dentata* (Schult.) Wimm. & Grab., Fl. Siles. 2/1: 266, 1829. ≡ *Cardamine pratensis* subsp. *dentata* (Schult.) Čelak., Prodr. Fl. Böhmen: 450, 1875.

= *Cardamine pratensis* var. *palustris* Wimm. & Grab., Fl. Siles. 2/1: 266, 1829. ≡ *Cardamine dentata* var. *palustris* (Wimm. & Grab.) Khatri, Feddes Repert. 97: 281, 1986. ≡ *Cardamine pratensis* subsp. *palustris* (Wimm. & Grab.) Janch., Phytion (Horn, Austria) 8: 236, 1959.

= *Cardamine palustris* Peterm., Bot. Centralbl. Deutschl. 1: 47, 48, 11 Feb. 1846.

≡ *Cardamine paludosa* Knaf, Flora 29: 293, 21 May 1846. ≡ *Cardamine pratensis* subsp. *paludosa* (Knaf) Čelak., Živa 4: 78, 1870.

= *Cardamine grandiflora* Hallier, Bot. Zeitung (Berlin) 24: 209, 1866.

= *Cardamine fragmentosa* Péntzes & Vida, Bot. Közlem. 53: 172, 1966.

– *Cardamine sylvatica* auct. non Link: Besser, Prim. Fl. Galiciae Austriac. 2: 76, 1809.



Fig. 1. *Cardamine dentata* Schult. (drawn from KRAM 377175). Scale bar: 5 cm.

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 \pm 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* Pourr., 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 Lövkvist (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 $2n = 30, 32, 38, 44, 50, 58$ and 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 (Zgłobice). However, on the map of this taxon published in the same year in *Atlas florae 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.

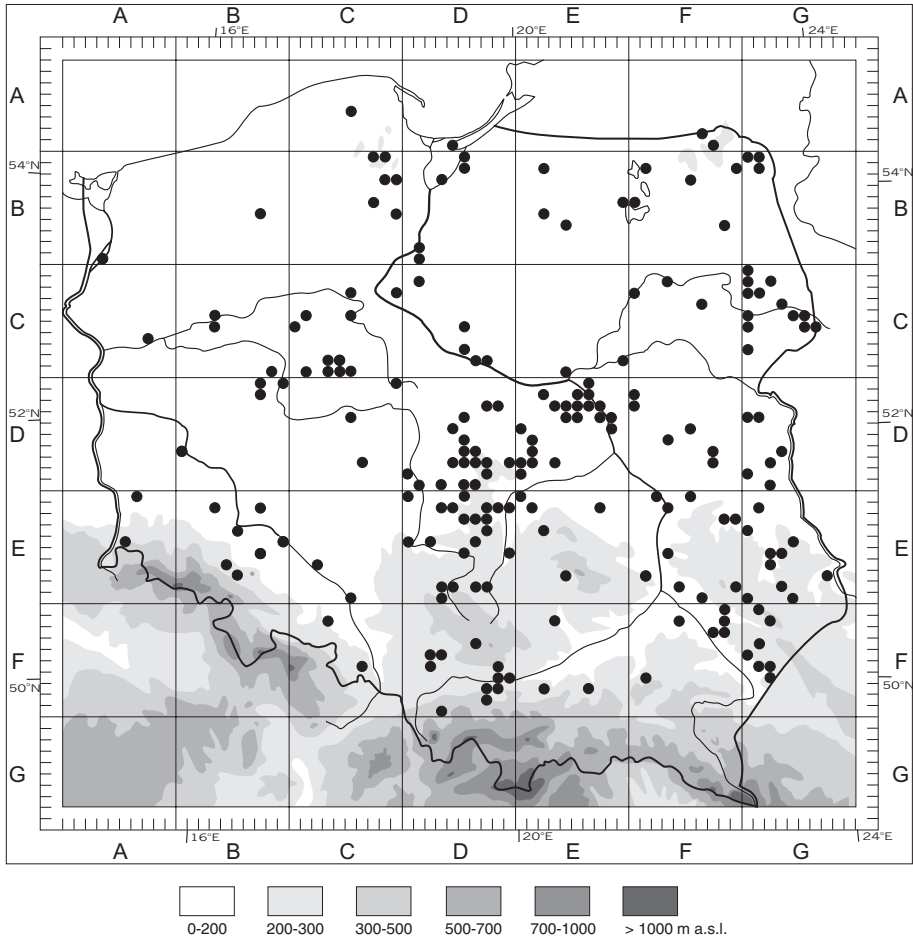


Fig. 2. Distribution of *Cardamine dentata* Schult. in Poland.

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-Carda-minetalia* 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 AC: 67 – Wieprzyce near Gorzów Wielkopolski, 18 May 1956, *leg. R. Matkowski* (LOD).

GRID SQUARE AE: 06 – Ruszów near Zgorzelec, 10 July 1888, *leg. J. Macker* (WRSL); **45** – Wrociszów near Lubań, 12 May 1963, *leg. A. Dziurdzik* (LOD).

GRID SQUARE BB: 57 – Jezioro Trzesiecko lake near Szczecinek, 04 June 1959, *leg. J. Majer & M. Radeberg* (LOD); Jezioro Czarne lake near Szczecinek, 10 June 1959, *leg. M. Mačkowiak* (WA).

GRID SQUARE BC: 43 – Lubcz near Krzyż, 30 May 1996, *leg. W. Paul* (KRAM); **53** – Miały near Czarnków, 25 May 1974, *leg. K. Latowski* (POZ) and 25 June 1974, *leg. K. Latowski* (POZ); **98** – Jezioro Kierskie Małe lake near Poznań, 29 May 1932, *leg. J. Paczowski* (POZ).

GRID SQUARE BD: 07 – Dopiewo, 16 May 1978, *leg. M. Budzisz* (POZ); **09** – Poznań-Malta, 07 May 1935, *leg. J. Łukowska* (POZ); Poznań-Szeląg, 25 May 1927, *leg. W. Sławiński* (POZ); **17** – Jezioro Jarosławickie lake, 15 July 1970, *leg. J. Lewandowska* (POZ); Stęszew near Poznań, 27 May 1936, *leg. F. Krawiec* (POZ); Wieś Łódź and Trzebów, ? April 1922, *leg. A. Pęcherska* (POZ), 22 May 1935, *leg. F. Krawiec* (POZ); **60** – Przyborów near Nowa Sól, 14 May 1968, *leg. Z. Dzwonko* (KRA); **82** – Głogów, ?.?.1851, *leg. ?. Mielke* (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); **49** – Wrocław, 24 & 26 May 1861, *leg. R. K. F. Uechtritz* (WRSL), 03 May 1878, *leg. R. K. F. Uechtritz* (WRSL), 12 May 1878; *leg. R. K. F. Uechtritz* (WRSL), 08 May 1885, *leg. R. K. F. Uechtritz* (WRSL); Wrocław-Bierdzany, 22 May 1861, *leg. R. K. F. Uechtritz* (WRSL); Wrocław-Książ Wielki, 29 May 1886, *leg. R. K. F. Uechtritz* (WRSL); Wrocław-Siedlec, ? May 1856, *leg. R. K. F. Uechtritz* (WRSL); **57** – Stary Dwór near Wrocław, ? June 1855, *leg. R. K. F. Uechtritz* (WRSL); **64** – Międzyrzecze near Strzegom, ? June 1865, *leg. ?. Zimmermann* (WRSL), 2 June 1865, *leg. ?. Zimmermann* (WRSL); **75** – Świdnica, 30 April 1877, *leg. W. Schöpke* (WRSL).

GRID SQUARE CA: 65 – Jezioro Lubowidzkie lake near Lębork, 06 June 1966, *leg. T. Jelinowski* (GDMA).

GRID SQUARE CB: 07 – Kłobuczyno, 30 May 1982, *leg. M. Buliński* (GDMA); **08** – Jezioro Ząbrsko Małe lake near Ząbrz Mały, 18 May 1975, *leg. M. Buliński* (UGDA); **28** – Maliki Górne – Góra, 18 May 1982, *leg. M. Buliński* (GDMA); **29** – Trzebińsk near Stargard Gdański, 19 Sept. 1973, *leg. T. Jelinowski* (GDMA); **47** – Czarna Woda near Kalisz, 23 Aug. 1978, *leg. T. Jelinowski* (GDMA); **59** – Jezioro Głuche lake near Głuche, 04 June 1976, *leg. T. Jelinowski* (GDMA).

GRID SQUARE CC: 25 – Bydgoszcz – Prądy, 14 May 1960, *leg. J. Majcherczyk* (LOD); **29** – Świerczynki near Toruń, 22 May 1956, *leg. ?. Jagielka* (LOD); **41** – Krzyżanki near Gołańcz, 15 May 1971, *leg. A. Bosacki* (TRN); **45** – Oporów near Łabiszyn, 03 May 1966, *leg. O. Szyński* (TRN); **50** – Kobylec near Wągrowiec, 01 May 1977, *leg. M. Szostak* (POZ); **83** – Gniezno, 19 May 1882, *leg. ?* (POZ), 18 May 1881, *leg. ?* (POZ); **84** – Between Janków and Kujawki, 14 May 1931, *leg. F. Krawiec* (POZ); **91** – Promno near Poznań, 04 May 1968, *leg. H. Markiewicz* (POZ); **93** – near Gniezno, 11 May 1935, *leg. J. Bąkowski* (POZ); **94** – Chełmy near Zgierz, las, 17 May 1947, *leg. J. Mowszowicz* (LOD); **95** – Skorzęcin, 16 May 1980, *leg. J. Chmiel* (POZ).

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

Sompolno, May 1892, *leg. K. Drymmer* (WA); **27** – Konin Warty, ? May 1970, *leg. H. Adamiak* (POZ); **35** – Zagórow near Konin, 10 June 1955, *leg. H. Łakomiak* (LOD); **76** – Kalisz, ? June 1963, *leg. P. Dyl* (LOD); **77** – Opatówek near Kalisz, ? July 1956, *leg. ? Wiewiórkowska* (LOD).

GRID SQUARE CE: 72 – near Brzeg, 24 May 1906, *leg. ? Schalow* (WRSL); **95** – Opole, 26 May 1969, *leg. G. Rutkowska & ? Hołyńska* (LOD).

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

GRID SQUARE DA: 94 – Grochowo III, distr. Elbląg, on Łaszka river, 03 June 1987, *leg. T. Szarejko* (OLS).

GRID SQUARE DB: 05 – Elbląg, 28 May 1968, *leg. B. Zerhan* (LOD); **15** – Družno, 16 May 1987, *leg. M. Buliński* (GDMA); Tropy Elbląskie, 23 May 1987, 09 June 1987, *leg. M. Buliński* (GDMA); Gronowo Górne, near Jezioro Družno lake, 02 June 1987, *leg. T. Szarejko* (OLS); **23** – Malbork – Kołdowo, 30 April 1967, *leg. B. Siedlecka* (WA); **81** – Grudziądz, 03 June 1883, *leg. J. Pecl*, (TRN); **91** – Płachawy near Wąbrzeźno, 28 April 1968, *leg. T. Dydo* (LOD).

GRID SQUARE DC: 11 – Orzechowo near Wąbrzeźno, 10 May 1962, *leg. K. Stempska* (POZ); **55** – Wólka near Lipno, 21 May 1959, *leg. M. Sokół* (TRN); **75** – Zakrzewo near Włocławek, 01 Aug. 1954, *leg. ? Śpiewakowski* (LOD); **86** – Soczewka near Płocka, 07 May 1971, *leg. W. Małecki* (LOD); **87** – near Płock, ? May 1887, *leg. A. K. Siemionow* (WA).

GRID SQUARE DD: 27 – Dobrzelin near Kutno, 15 May 1954, *leg. B. Wojtczak* (LOD); **28** – Złaków Kościelny near Zduny, 25 June 1965, *leg. J. Woźniak* (LOD); **35** – Wały near Kutno, 26 June 1972, *leg. A. Augustyniak* (LOD); **44** – Błonie near Łęczycza, 20 April 1921, *leg. B. Hryniewiecki* (WA); Tum near Łęczycza, 11 May 1969, *leg. K. J. Kurowski* (LOD); **55** – Sokolniki near Łódź, ? May 1967, *leg. ? Grosman* (LOD); **65** – Grotniki near Łódź, ? June 1949, *leg. A. Zielińska* (LOD); **66** – Łódź, 07 June 1986, *leg. M. Sokołowska & J. Woźniak* (LOD), 14 May 1954, *leg. L. Pastuszko* (LOD); Łódź-Łagiewniki, 19 April 1974, *leg. ? Wajs & ? Jabłecka* (LOD), 10 May 1953, *leg. R. Sowa*, (LOD); Uroczysko Chełmy near Zgierz, ? Sept. 1976, *leg. M. Pawłowska* (LOD); Uroczysko Szczawin, 13 May 1972, *leg. E. Filipiak* (LOD); **74** – Zofiówka near Lutomiersk, 30 June 1969, *leg. E. Ubysz* (LOD); **75** – Romanów near, 17 June 1978, *leg. A. Pabiniak* (LOD); Rszew near Konstantinowa, 29 June 1957, *leg. T. Mączyńska* (LOD); Konstantinów Łódzki, rów, 03 June 1949, *leg. J. Petela & H. Ignaczak* (LOD), 03 June 1949 *leg. A. Szymańska* (LOD); **76** – Dąbrówka near Nowosolna, ? May 1955, *leg. ? Zdanowicz* (LOD); Łódź-Rogi, 03 May 1949, *leg. J. Mowszowicz* (LOD); **77** – Gałkówek near Koluszki, 30 May 1973, *leg. Leśnikowska* (LOD); Gałkówek near Łódź, 25 June 1949, *leg. Z. Miśkiewicz, ? Tykowski, E. Marande & J. Gałkiewicz* (LOD); **79** – Rogów, 07 June 1928, *leg. W. Niedziałkowski* (WA); **80** – Bartochów near Sieradz, 06 June 1969, *leg. M. Krakowska* (LOD); **87** – Justynów near Łódź, 28 April 1957, *leg. R. Olaczek* (LOD); Kraszew near Łódź, ? June 1973, *leg. E. Olszewska* (LOD); **91** – Męcka Wola, 01 May 1966, *leg. M. Kieszniewska* (LOD); Sieradz, ? May 1964, *leg. A. Wojewoda* (LOD); **93** – Łask, ? June 1957, *leg. M. Tkaczuk* (LOD); **95** – Chechło near Łask, 06 May 1969, *leg. D. Ogłaza* (LOD); **96** – Modlnica k. Tuszyna, 07 May 1950, *leg. J. Bogustawski & H. Witkowska* (LOD).

GRID SQUARE DE: 00 – Ruszków near Sieradz, 10 June 1969, *leg. T. Załuski* (LOD); **05** – Pawłowa near Zelów, 10 June 1977, *leg. H. Cieślak* (LOD); **13** – Lubiec near Szczerców, 28 June 1964, *leg. M. Wróblewska & D. Krzywański* (LOD); **14** – Lubiec near Bełchatów, ?? 1964, *leg. B. Kala* (LOD); Zbyszek near Szczerców, 05 June 1978, *leg. L. Kucharski & W. Przybylińska* (LOD); **17** – Piotrków Trybunalski, 05 May 1974, *leg. R. Sipa* (LOD); **18** – Piotrków Trybunalski – Bugaj, ? May 1974, *leg. ?* (LOD); **19** – Błogie near Mniszków, 21 May 1979, *leg. M. Kurzac* (LOD); Nature reserve Lubiaszów near Piotrków Trybunalski, 15 May 1963, *leg. B. Belul* (LOD); **25** – Bełchatów, 19 May 1973, *leg. J. Marchewka* (LOD); **26** – Postękalice near Bełchatów, 15 June 1955, *leg. M. Sidowski & W. Szklarek* (LOD); **27** – Rozprza near Piotrków, 06 June 1977, *leg. L. Fagasiewicz* (LOD); **37** – Gorzkowice near Piotrków Trybunalski, 15 June 1988, *leg.*

I. Strzelecka (LOD); **40** – Kamionka near Wieluń, 10 June 1969, *leg. D. Kmiecik* (LOD); **42** – Działoszyn near Pajęczno, 07 May 1951, *leg. J. Błaszczuk* (KRA); **46** – Gomunice, 09 May 1988, *leg. M. Lesiak* (LOD); **55** – Topisz near Radomsko, 15 June 1970, *leg. D. Grabowska* (LOD); **59** – Uroczysko Wierchlas near Wojciechów, 15 July 1971, *leg. U. Ziętał* (LOD); Wierchlas near Wojciechów, 18 July 1971, *leg. K. Wojak* (LOD); **83** – Częstochowa, on Warta river, 09 May 1978, *leg. A. Tyrała* (KTU); **84** – Mirów near Częstochowa, 12 May 1965, *leg. Wankiewicz* (LOD); **86** – Wola Mokrzaska near Przyrów, ? May 1964, *leg. B. Wójcik* (LOD); **87** – Koniecpol near Częstochowa, 26 Aug. 1949, *leg. M. Ormanowska* (LOD); **93** – Konopiska (Pająk), 28 April 1974, *leg. U. Baranowska* (LOD).

GRID SQUARE DF: **36** – Pustynia Błędowska, 23 May 1955, *leg. T. Tacik* (KRA); **42** – Nowy Bytom, 03 June 1955, *leg. L. Ludynia* (LOD); **43** – Katowice, 20 May 1976, *leg. B. Hauer* (KTU); Mysłowice, 29 May 1976, *leg. A. Sendek* (KTU); Sosnowie, 15 July 1966, *leg. B. Wójcik-Chrobol* (LOD); **52** – Mikołów-Jamna, 18 May 1998, *leg. A. Urbisz* (KTU); **58** – Zabierzów, 25 May 1951, *leg. W. Giżyńska* (KRA); Rudawa, 02 May 1936, *leg. B. Ferens* (KRA); **68** – Skała Kmity near Zabierzów, 21 May 1949, *leg. J. Kornaś* (KRA); **69** – Kraków-Czarna Wieś, 01 May ?, *leg. S. Węgrzyn* (KRAM); Kraków-„Koło Tynieckie”, 20 May 1955, *leg. T. Tacik* (KRAM); Kraków-Ludwinów, 19 May 1908, *leg. A. Żmuda* (KRAM); **77** – Przeginia Duchowna near Czernichów, 18 May 1955, *leg. K. Zarzycki* (KRAM); **78** – Skawina, 06 May 1950, *leg. B. Pawłowski* (KRA, KRAM); **87** – Kalwaria Zebrzydowska, 22 May 1965, *leg. E. Baradziej* (KRA); **93** – Bielsko-Biała, 15 May 1955, *leg. B. Labuś* (LOD).

GRID SQUARE EB: **12** – Łaniewo near Lidzbark Warmiński, 16 May 1979, *leg. M. Dzwonczak* (LOD); **49** – Mikołajki-Ruciane, Łąki Lisuńskie meadows, 03 June 1976, *leg. W. Pietraszewski* (OLS); **52** – Olsztyn-Kortowo, 25 May 1954, *leg. B. Polakowski* (OLS); Olsztyn, Posorty on Jezioro Kortowskie lake, 16 May 1954, *leg. H. Wojciechowska* (OLS), 19 May 1954, *leg. J. Huttorowicz* (OLS); **64** – Pasym near Olsztyn, 20 July 1948, *leg. W. Puciata* (LOD).

GRID SQUARE EC: **89** – Wyszaków, 15 May 1969, *leg. M. Sunkowski & M. Zawistowska* (LOD); **94** – Modlin, 31 May 1956, *leg. K. Dzikowska* (LOD).

GRID SQUARE ED: **06** – Legionowo ? April 1974, *leg. D. Gawdzik* (LOD); **12** – Kampinos, ??, 1923, *leg. R. Kobendza* (WA); **15** – Zalesie near Warszawa, ? May 1972, *leg. Roszkiewicz* (LOD); **16** – Buraków near Warszawa, 28 April 1974, *leg. M. Dąbrowska* (LOD); Warszawa-Bielany, ?, *leg. K. Łapczyński* (WA); **23** – Bieniewo, near Pruszków, 06 May 1966, *leg. K. Nowak* (WA); Radonice near Pruszków, 28 April 1968, *leg. K. Nowak* (WA); **24** – Błonie near Pruszków, 01 May 1973, *leg. M. Łukasiewicz* (LOD); **25** – Żbików near Pruszków, 15 May 1968, *leg. K. Nowak* (WA); **26** – Warszawa-Mokotów Dolny, ? June 1975, *leg. E. Połatyńska* (LOD); Warszawa-Służewiec, 15 April 1974, *leg. R. Dawidson* (LOD); **27** – Warszawa-Saska Kępa, 02 June 1974, *leg. J. Zawistowski* (LOD); Wilanów, 05 May 1949, *leg. K. Rulikowska* (WA), ? May 1971, *leg. ?. Czarnogórska* (LOD), ? May 1974, *leg. D. Stumpto*, (LOD), ?, *leg. Sznabel* (WA); Warszawa-Stegny, ? June 1975, *leg. B. Pańkowska* (LOD); **34** – Brwinów, 25 May 1963, *leg. M. Rucińska* (WA); **35** – Komorów near Michałowice, 24 June 1970, *leg. A. Koelichen* (LOD); Nowa Wieś Warszawska, 04 June 1972, *leg. K. Frołow & H. Karbonowska* (LOD); Pęcice, 28 April 1963, *leg. M. Gągała* (WA); **37** – Konstancin-Jeziorna, 13 May 1978, *leg. A. Markuszewska* (LOD); **38** – Świder near Otwock, 28 May 1976, *leg. Sobiechowska* (LOD); **40** – Bełchów near Łowicz, 20 April 1950, *leg. S. Wilkówna* (LOD); **48** – Góra Kalwaria, 15 May 1956, *leg. ?. Kowalkowska* (LOD); **51** – Rawa near Skierniewice, 04 June 1974, *leg. Z. Osińska* (LOD); **61** – Stara Rawa near Nowy Kawęczyn, 15 May 1979, *leg. T. Bogulewska* (LOD); **70** – Łochów near Rawa Mazowieck, 14 May 1954, *leg. H. Kacprzyk* (LOD); **71** – Rawa Mazowiecka, 03 May 1971, *leg. J. Seń* (LOD); **73** – Biała Rawska near Skierniewice, 20 May 1988, *leg. J. Urbaniak* (LOD); **80** – Żelechlinek near Rawa Mazowiecka, 17 May 1954, *leg. C. Kowalski* (LOD).

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

Tomaszów Mazowiecki, 23 June 1954, *leg. J. Wierzbowska* (LOD); **11** – Kamień near, 14 May 1978, *leg. W. Kicińska* (LOD); **17** – Radom, 10 June 1956, *leg. ? Żelazny* (LOD); **32** – Końskie, rów, 20 May 1978, *leg. J. Juszcak* (LOD); **74** – Karczówka near Kielce, 19 June 1934, *leg. I. Lebkowska* (WA).

GRID SQUARE EF: 13 – Pińczów, 25 May 1999, *leg. W. Paul* (KRAM); **72** – Stanisławice, Puszcza Niepołomińska forest, 05 May 1963, *leg. K. Luchter* (KRA); Grodkowice, 14 May 1959, *leg. S. Pojarska* (KRA); **76** – Zgłobice near Tarnów, ? May 1828, *leg. ? Herbich* (LW).

GRID SQUARE FA: 86 – Dubieninki near Gołdap, 05 June 1969, *leg. A. Sokołowski* (BIL); **97** – Bachanowo near Suwałki, 29 July 1969, *leg. A. Sokołowski* (BIL).

GRID SQUARE FB: 11 – Giżycko, 21 April 1956, *leg. A. Łobaszewska* (LOD); **19** – Jezioro Staw lake near Wigry lake, 23 May 1921, *leg. B. Hryniewiecki* (WA); **25** – Przytuły near Ełk, 26 May 1956, *leg. M. Jaromiński* (LOD); **40** – Jezioro Łuknajno, brzeg wschodni, 12 July 1966, *leg. B. Polakowski* (OLS); **68** – Grzędy nature reserve near Rajgród, ? July 1935, *leg. K. Lubliner* (WA).

GRID SQUARE FC: 13 – Jednaczewo, 20 May 1964, *leg. Bukowski* (WA); **20** – Ostrołęka, 23 May 1961, *leg. J. Gałazka* (LOD); **36** – Glinki near Wysokie Mazowieckie, 06 June 1970, *leg. J. Kozak* (BIL).

GRID SQUARE FD: 10 – Wólka Czarnińska, 05 May 1963, *leg. K. Pachół* (WA); **20** – Mińsk Mazowiecki, 16 May 1964, *leg. U. Glewczyńska* (WA); Targówka near Mińsk Mazowiecki, 25 May 1971, *leg. J. Zdziarska* (LOD); **45** – Gręzówka near Łuków, 13 May 1970, *leg. D. Fijałkowski* (LBL); **53** – Stoczek Łukowski, 17 Aug. 1978, *leg. E. Madura* (LBL); Powąły, 07 May 1970, *leg. D. Fijałkowski* (LBL); **67** – Radzyń Podlaski, 15 May 1974, *leg. B. Milaniuk* (LBL); **77** – Sitno near Radzyń Podlaski, 18 May 1970, *leg. D. Fijałkowski* (LBL).

GRID SQUARE FE: 02 – Gołęb, near Puławy, rów odwadniający, 13 June 1972, *leg. A. Gelo* (LBL); **05** – Wólka Kątna near Lublin, 12 May 1974, *leg. Z. Buczkowska* (LBL); **13** – Puławy – Włostowice, 06 May 1959, *leg. D. Fijałkowski* (LBL); **28** – Lublin, 12 June 1951, *leg. D. Fijałkowski* (LBL); Sobianowice, 08 June 1951, *leg. D. Fijałkowski* (LBL); **29** – Trzeszkowice near Lublin, 07 June 1964, *leg. E. Zielińska* (LBL); **53** – Mazarów near Józefów on Wisła, 20 May 1970, *leg. D. Fijałkowski* (LBL); **71** – Wojnowice near Opałów, 29 May 1960, *leg. G. Stefańska* (LOD); **84** – Zaklików, 25 May 1964, *leg. Blinowska* (LBL); **89** – Hosznia Ordynacka near Gródek, 16 May 1973, *leg. D. Fijałkowski* (LBL); **96** – Ciechocin near Janów Lubelski, 12 May 1972, *leg. D. Fijałkowski* (LBL).

GRID SQUARE FF: 08 – Dąbrowica near Biłgoraj, 29 May 1964, *leg. D. Fijałkowski* (LBL); **14** – Puszcza Sandomierska forest, ?.?.1867, *leg. Jachno* (KRAM); **18** – Budziarze near Biłgoraj, 06 May 1976, *leg. J. Cios* (LBL); Wólka Biska, 17 May 1976, *leg. J. Cios* (LBL); **27** – Lipiny Górne near Tarnogród, 15 May 1964, *leg. D. Fijałkowski* (LBL); **28** – Szyszków near Tarnogród, 22 May 1974, *leg. D. Fijałkowski* (LBL); **61** – Paszczyzna near Dębica, 01 May 1954, *leg. H. Gałuszka* (LOD).

GRID SQUARE GB: 00 – Żubrówka near Suwałki, 16 July 1969, *leg. A. Kawecka* (BIL); **01** – Sejny, 14 June 1976, *leg. K. Dyga* (WA); **11** – Giby, 22 May 1975, 02 July 1975, *leg. B. Sudnik* (WA), 25 May 1975, *leg. H. Werblan-Jakubiec* (WA); Jezioro Dowcień lake near Giby, 17 July 1975, *leg. Mazek* (WA); Jezioro Gieret lake, 03 Aug. 1975, *leg. J. Borowa* (WA); Jezioro Wiłkokuk lake, 02 Aug. 1975, *leg. J. Poptawska* (WA).

GRID SQUARE GC: 00 – Czarna Wieś, las mieszany, *leg. M. Wójcicka*, 20 May 1934 (WA); **10** – Białystok, 19 June 1970, *leg. D. Leszczyńska* (LOD); **12** – Bobrowa near Białystok, 15 May 1969, *leg. A. Sokołowski* (BIL); **20** – Trypucie near Łapy, 16 June 1970, *leg. ? Janik* (LOD); **21** – Zagruszany near Białystok, 19 May 1970, *leg. S. Borowiak* (BIL); Skrybicz, 19 May 1970, *leg. J. Żurawski* (BIL); **33** – Rybaki near Hajnówka, 29 May 1970, *leg. J. Żurawski* (BIL); **40** – Mieszuki near Bielsk Podlaski, 04 June 1970, *leg. N. Romańczuk* (BIL); Stacewicze near

Bielsk Podlaski, 04 June 1970, *leg. J. Kozak* (BIL); **44** – Kapitańszczyzna near Hajnówka, 12 May 1969, *leg. A. Sokołowski* (BIL); **45** – Browsk forest div. near Hajnówka, 01 June 1970, *leg. N. Romańczuk* (BIL); **50** – Nałogi near Bielsk Podlaski, 16 May 1969, *leg. A. Sokołowski* (BIL); Stryki, 02 June 1970, *leg. N. Romańczuk* (BIL); **55** – Puszcza Białowieska forest, sect. 254, 17 June 1966, *leg. A. Sokołowski* (BIL); **56** – Białowiecki National Park/Puszcza Białowieska forest, 28 May 1888, *leg. A. Ejsmond* (WA), 18 April 1948, 13 Sept. 1948, 07 May 1949, 11 May 1949, 27 May 1949, *leg. A. Sokołowski*, (BIL); on Hwoźna river, 13 May 1970, *leg. A. Sokołowski* (BIL); Puszcza Białowieska forest, sect. oddz. 345, 24 Aug. 1965, *leg. A. Sokołowski* (BIL); **70** – Boćki kolonia near Bielsk Podlaski, las sosnowo-olszynowy, 26 May 1970, *leg. J. Żurawski* (BIL); Dubno, 26 May 1970, *leg. S. Fieńko* (BIL).

GRID SQUARE GD: 30 – Woroniec, 30 April 1887, *leg. F. Kwieciński* (WA); **31** – Biała Podlaska, 18 May 1956, *leg. ? Łukaszuk* (LOD); **63** – Matiaszówka near Wisznice, 13 May 1973, *leg. D. Fijałkowski* (LBL); **72** – Dębów near Wisznice, 12 May 1973, *leg. D. Fijałkowski* (LBL); **80** – Parczew, 08 May 1976, *leg. U. Korniluk* (LBL); **92** – Stawinek [near Dęblin], staw, 06 May 1942, *leg. L. Reweński* (LBL).

GRID SQUARE GE: 11 – Kaniwola near Łęczna, on Jezioro Uściwierz lake, 13 May 1954, 13 May 1959, *leg. D. Fijałkowski* (LBL); **30** – Kol. Siostrzenice near Piasek, 14 May 1959, *leg. D. Fijałkowski* (LBL); **44** – Deputycze near Chełm, 16 June 1970, *leg. D. Fijałkowski* (LBL); **52** – Krasnystaw, 16 June 1973, *leg. I. Dudek* (LBL); Rońsko, 04 May 1974, *leg. Fijałkowski* (LBL); **53** – Łukaszówka near Krasieczyn, 15 May 1972, *leg. D. Fijałkowski* (LBL); **62** – Krasne, pow. Hrubieszów, 24 May 1958, *leg. D. Fijałkowski* (LBL); **77** – Hrubieszów, 22 May 1972, *leg. J. Panasiewicz* (LBL); **83** – Łabuńki near Zamość, 17 July 1971, *leg. D. Fijałkowski* (LBL); **90** – Kawęczyn near Szczepieszyn, 29 May 1965, *leg. D. Fijałkowski* (LBL); Topólca, 29 May 1965, *leg. D. Fijałkowski* (LBL); **94** – Dzierążnia Kościelna near Tomaszów Lubelski, 14 July 1958, *leg. M. Szozda* (LBL).

GRID SQUARE GF: 01 – Szumy nature reserve near Krasnobród, 24 May 1974, *leg. D. Fijałkowski* (LBL); **12** – Susiec near Tomaszów, 26 May 1973, *leg. D. Fijałkowski* (LBL); **31** – Zamch near Biłgoraj, ? June 1959, *leg. T. Krzaczek* (LBL); **40** – S of Mołodycz-Grobla, 14 May 1999, *leg. W. Paul* (KRAM); **51** – Czerniawka, 21 May 1999, *leg. W. Paul* (KRAM); **52** – Łukawiec-Sudry, 21 May 1999, *leg. W. Paul* (KRAM); **62** – Between Młyny and Budzyń, 17 May 1999, *leg. W. Paul* (KRAM); 16 May 2001, *leg. J. J. Wójcicki & W. Paul* (KRAM).

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