Cytotaxonomical study of *Caltha palustris*

Cytotaxonomická studie druhu *Caltha palustris*

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Authors have divided the populations of *Caltha palustris* L. from the Czech Republic into four subspecies: subsp. *cornuta* (Schott, Nyman et Kotschy) Hegi with 2n = 32 chromosomes, subsp. *laeta* (Schott, Nyman et Kotschy) Hegi with 2n = 32 (34) in lowland and with 2n = 56 (57, 58, 59, 61, 64) in mountains, subsp. *palustris* with 2n = 32 (34, 35, 36) chromosomes, and subsp. *procumbens* (Beck) Neumayer with 2n = 56 (55, 57, 59, 56 + 6B) chromosomes. The chromosome numbers of 2n = 32, 44, 47 were also found in some intermediates. Chromosome counts for 88 samples are presented. Great variation in morphological features were found in all subspecies. Morphological characters are independent of each other, ecological conditions influence some of their values. Results are given for plants in wild, in herbaria and for 129 samples cultivated in an experimental field.

Keywords: *Caltha palustris*, *Ranunculaceae*, taxonomy, chromosome numbers, Czech Republic, Slovak Republic, Rumania

Introduction

About 40 species belong to the genus *Caltha* (*Ranunculaceae*), 20–25 of them occur in the northern hemisphere and are placed to the subgenus *Caltha*. In the Czech Republic and Slovakia only one species is present, the very variable *C. palustris* L. It represents a very polymorphic complex of lower taxa, classified by different authors as species, subspecies, varieties, forms or only as ecological variants (Beck 1886, Huth 1892, Smit 1967, 1968, 1973, Chrtková 1988). *C. palustris* is a common species in the Czech and Slovak Republics, distributed all over the territory, in various ecological conditions and altitudinal belts. This study has resulted especially from cytogeographical analyses and can be a basis for further study of relationships among the subspecies of *Caltha palustris*.

Material and methods

The objects of study were herbarium sheets, plants cultivated in an experimental field, and individuals and populations in nature. Experimental plants (cultivated in an experimental garden of the Institute of Botany in Průhonice near Prague, in the years 1976–1986) originated mostly from natural habitats in the Czech and Slovak Republics. Some plants from Rumania, Bulgaria and Poland were also added. Vaucher specimens are deposited in the herbarium of the National Museum in Prague (PR). Part of cultivated plants (88 samples) were used for cytological study. One or two plants were used for chromosome studies from each sample. Root tips of cultivated plants were pre-treated with p-dichlorobenzene, fixed in alcohol-acetic acid 3 : 1 mixture and stained with lacto-propionic-orceine.
Key to the subspecies of *Caltha palustris*

1a Ripe follicles straight or slightly curved; the dorsal side straight or slightly curved; the ventral side strongly curved; beak ± straight. Stems erect or ascending; leaves reniform, reniform cordate, rounded cordate or sagittate, (5–) 8–15 (–22) cm in diameter, serrulate-dentate, dentate or crenate; flowers bright or golden yellow, 25–32 mm in diameter, perianth segments ovate to broadly ovate, mostly not contiguous

........................................................................................................... **subsp. laeta** (Schott, Nyman et Kotschy) Hegi

1b Ripe follicles curved outside, both on the dorsal and ventral side; beak curved ........................................................................... 2

2a Ripe follicles strongly curved in a bow, mostly only 2.5–3.4 mm broad, slowly narrowed to the apex; beak ± 2 mm long; leaves often longer than broad. Stems erect, rarely ascending, long, robust; leaves cordate to nearly orbicular, (10–) 15–25 (–26) cm in diameter, serrulate, serrulate-dentate or dentate; flowers large, bright to dark golden yellow, 28–40 mm in diameter, perianth segments broadly ovate, with the margins mostly overlapping ........................................................................... **subsp. cornuta** (Schott, Nyman et Kotschy) Hegi

2b Ripe follicles in an S-shape curved, mostly (3–) 4–5 (–6) mm broad, suddenly narrowed to the apex; beak ± 1.5 mm long; leaves mostly broader than long ........................................................................... 3

3a Stems mostly decumbent, procumbent or creeping, rooting at the nodes in fruiting stage, rarely in the flower. Leaves orbicular, reniform or cordate-reniform, (2–) 5–20 cm in diameter, crenate or dentate; flowers pale, bright to golden yellow, often smaller than 25–30 mm in diameter, perianth segments oblong or ovate, not or only rarely overlapping ........................................................................... **subsp. procumbens** (Beck) Neumayer

3b Stems erect or rarely ascending, not rooting at the nodes. Leaves reniform or cordate-reniform or orbicular, 6–20 (–26) cm in diameter, serrulate-dentate, dentate, crenate or entire; flowers golden yellow, 25–33 mm in diameter, perianth segments oval or broadly oval, often with overlapping margins ........................................................................... **subsp. palustris**

Morphological characters

A wide variation of some morphological characters in *Caltha palustris* is influenced to a high degree by external environment. The length of stems (mean 30–50 cm) is dependent on the height and elevation of water level, or on the nutrition contents of the soil. Nevertheless, in subsp. *cornuta* long, erect stems are more common; in contrast, in the mountain forms of subsp. *laeta* short stems predominate. In subsp. *procumbens* the stems are sometimes very long, up to 2 m in creeping plants. Plants grown in the experimental field, however, lost their extremely long stems in the years following the transplantation. The size and shape of leaves, the form of the margin of leaves, the colour of petioles and the colour and shape of perianth segments change both during one or several years and on the same plant. *C. palustris* subsp. *cornuta* has leaves usually longer than broad, the others three subspecies have leaves broader than long. The flowers are largest in subsp. *cornuta* and smallest in subsp. *procumbens*. For the latter this only holds true in the wild while in the experimental field they reach nearly the average values of subsp. *palustris*. These unsteady characters were often used for differentiation of subspecies, varieties, forms and rarely species.

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Stems rooting at the nodes and namely the shape and position of follicles are relatively constant characters. The stems rooting during the late spring or more often in summer are characteristic of the subsp. *procumbens*. However, this character needs not appear every year. In the experimental field the sample no. 12, 13, 50 (2n = 56) did not root over several years. Rarely, plants of subsp. *palustris* were weakly rooting when covered by earth in some seasons.

The form of the follicles – clearly defined only in the ripe follicles – is considered as the most important character for distinguishing particular subspecies (Fig. 1). Subsp. *cornuta* has the follicles strongly bowed outside or gradually narrowed to the apex. Subsp. *laeta* has the follicles straight or slightly curved or suddenly narrowed to the apex. Subsp. *palustris* and subsp. *procumbens* have the follicles curved in an S-shape, suddenly narrowed to the apex. Subsp. *palustris* and subsp. *laeta* are sometimes connected by plants of intermediate character in habitats of common occurrence. In the wild, subsp. *procumbens* has smaller and only few follicles but the difference is not so clear in the experimental field.

**Karyology**

The collective species *C. palustris* proves to be variable also in its karyology. Numerous papers concerned with its chromosome numbers contain both the individual data and cytogeographical studies (see Fedorov et al. 1969, Goldblatt 1981, 1984, Goldblatt & Johnson 1990, 1991). Especially the European populations have been thoroughly examined (Reese 1954, Wcislo 1967, Smit 1967, 1970). The lowest number of 2n = 16 has been recorded only in plants collected in Italy (Leoncini 1951) and the Caucasus (Gvinianidze & Avazneli 1982, Davalianidze 1984). The further two cytotypes of polyploid series 2n = 32 and 2n = 56 are prevailing in whole area of the complex, whereas next euploids of 2n = 48, 64, 72, 80, 88 occur rarely. Besides the euploids also aneuploid chromosome numbers fluctuating around 2n = 32 and 56 and B-chromosomes have been reported (Leoncini 1952, Maugini 1953, Reese 1954, Wcislo 1967, Kootin-Sanwu & Woodell 1970, Malick & Mary 1970, Bismark & Bässler 1974). Previous cytological records were usually given under the name *C. palustris* L. However, the taxonomic interpretation of the karyological differentiation mentioned remains rather obscure in *C. palustris*. According to Reese (1954) its variation in chromosome number is not correlated with its variation in the morphological characters; this phenomenon is termed as intrasubspecific ploidy by him. Wcislo (1967) has divided her Polish collections to three subspecies (subsp. *cornuta*, subsp. *genuina* and subsp. *laeta*) on the basis of their morphological characters and identified them with three cytotypes (2n = 32, 56 and 56). According to that author, nevertheless, many Polish plants could not be reliably classified taxonomically. The interpretation of Smit (1967) resembles the opinion of Reese (1954); she has found and statistically verified differences between morphological characters and cytotypes. She did not consider these differences sufficient for dividing this complex and retained both ploidies (2n = 32 and 56) in one species, i.e. *C. palustris*.

The results of our karyological examinations are summarized in the Appendix 1. *C. palustris* subsp. *cornuta* appears to be exclusively tetraploid (2n = 32) throughout its South-Moravian and South-Slovak distribution area. This is in accordance with previous findings from Slovakia where only tetraploid counts from 15 localities were detected
Fig. 2. - Localities of *Caltha palustris* plants from the Czech Republic in which the chromosome numbers were determined. • subsp. *palustris*, □ subsp. *laeta* (low ploidy level), ■ subsp. *laeta* (high ploidy level), ◇ subsp. *cornuta*, ◆ subsp. *procumbens*, ○ intermediates. Drawn by J. Chrték
Fig. 3. – Localities of *Caltha palustris* plants from Slovakia in which the chromosome numbers were determined. ■ subsp. *laeta* (low ploidy level), ○ subsp. *laeta* (high ploidy level), ◇ subsp. *cornuta*. Drawn by J. Chrtk sen.
(Uhriková in Majovský et al. 1978). *C. palustris* subsp. *procumbens* is characterized by a higher ploidy level (2n = 56); aneuploid numbers (55, 57, 59) and small supernumerary chromosomes (6B) have been also found. The tetraploid chromosome number 2n = 32 (incl. aneuploid numbers 2n = 34, 35, 36) was recorded in the plants of *C. palustris* subsp. *palustris*. The highest karyological diversity has been found in *C. palustris* subsp. *laeta*. The lowland collections were predominantly tetraploid with 2n = 32 (34), whereas the plants from the mountains had mostly higher ploidy level with 2n = 56 (57, 58, 59, 61, 64). Both chromosome numbers (32, 56) were previously reported from Slovakia, too (Majovský, Murin et al. 1987). It should be added that the plants from southernmost part of the species distribution indicate different results. The mountain plants collected in Rumania were exclusively tetraploid. This is in accordance with Wcislo’s report from Bulgaria. Intermediate forms between subsp. *laeta* and subsp. *palustris* are usually tetraploid with 2n = 32; in one case a hypohexaploid with 2n = 47 has been recorded and in one case presumable on F₁ hybrid between two different polyploids (32 and 56) with 2n = 44 has been detected.

**Ecology and distribution**

The habitat of *C. palustris* are wet meadows, marshes, peat-bogs, fens, banks of rivers and streams, shallow brooks, margins of lakes and ponds, reed-swamps, riverine forests, wet spruce forests, alders and similar places. Subsp. *cornuta* grows mostly in deeper water, subsp. *procumbens* in wet places in shallow water, subsp. *palustris* and subsp. *laeta* in wet places and margins of water bodies with shallow water (Chrtkova 1988).

*Caltha palustris* is distributed all over the territory of the Czech Republic (Fig. 2). Subsp. *palustris* occurs mainly in lowland and hilly parts of central, northern, eastern and rarely southern Bohemia and northern and southern Moravia, rarely in the Jeseníky and Krkonoše Mts up to 1200 m a. s. l. Subsp. *laeta* grows mainly in hilly and mountain regions in southwestern and southern Bohemia (in the Sumava Mts many plants are not typical) and norhem and central Moravia from 370 to 1450 m a. s. l. In the regions, where both these subspecies grow together, intermediate forms have been also found (central, northern, eastern and southern Bohemia and northern Moravia). Subsp. *procumbens* is distributed mostly in hilly regions and lower mountains in 380–800 m a. s. l., mainly in western and southwestern Bohemia and western and northern Moravia. The latter subspecies occurs together with subsp. *palustris* in western Bohemia (above all in the district of the town Plzeň) and in northern Moravia, and with subsp. *laeta* in southern Bohemia. Subsp. *cornuta* occurs only in southeastern Moravia (Chrtkova 1988). The most common infraspecific taxon of *C. palustris* in the Slovak Republic (Fig. 3) is subsp. *laeta*; it is growing mainly in the mountains. Subsp. *cornuta* occurs in southern Slovakia, distribution of subsp. *palustris* is unclear and needs further study, subsp. *procumbens* probably does not occur in Slovakia.

**Conclusions**

*Caltha palustris* is a very variable species. Its infraspecific taxa are of a different value. The best defined subspecies is subsp. *cornuta*, which is the most uniform in morphological characters, number of chromosomes (2n = 32) and ecology. Subsp. *procumbens* is mostly characterized by rooting of the nodes and in number of chromosomes (usually 2n = 56, oc-
casionally aneuploids of $2n = 55, 57, 59$ and once $6B$-chromosomes have been found. Subsp. *palustris* and subsp. *laeta* are closely related taxa, the values of their morphological characters overlap and their habitat preferences are similar. It seems that both subspecies are taxa in a state of continued differentiation. Subsp. *palustris* is tetraploid with $2n = 32$ (34–36) while subsp. *laeta* is characterized by a higher diversity of chromosome numbers. The lowland collections were predominantly tetraploid ($2n = 32$) whereas the higher ploidy ($2n = 56–64$) was ascertained in the mountain plants from the Czech and Slovak Republics. In contrary, only tetraploids ($2n = 32$) have been found in the mountain individuals collected in Rumania. Subsp. *laeta* and subsp. *palustris* form intermediates ($2n = 32; 44, 47$) and in one case the chromosome number in agreement with F, hybrid between two different polyploid levels ($2n = 44$) was detected.

**Souhrn**


**References**


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Appendix 1. – Results of cytogeographical analysis in *Caltha palustris*.

<table>
<thead>
<tr>
<th>strain number</th>
<th>Locality, coll.</th>
<th>Altitude (m a. s. l.)</th>
<th>2n</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C. palustris subsp. cornuta</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>S Moravia, at the pond Pouzdřanský rybník near the village Pouzdřany, Šourková M. 1976</td>
<td>170</td>
<td>32</td>
</tr>
<tr>
<td>3</td>
<td>S Moravia, below the dam of the pond Pouzdřanský rybník near the village Pouzdřany, Šourková M. 1976</td>
<td>170</td>
<td>32</td>
</tr>
<tr>
<td>1</td>
<td>S Moravia, flood plain forest near the village Lednice, Slavíková Z. 1976</td>
<td>160</td>
<td>32</td>
</tr>
<tr>
<td>15</td>
<td>E Slovakia, wet meadows below the railway near the village Streda nad Bodrogom, Chrtková A. 1976</td>
<td>90</td>
<td>32</td>
</tr>
<tr>
<td>16</td>
<td>E Slovakia, bridge across the river Latorica and the road between villages Kráľovský Chlmec and Veľké Kapušany (ca 6 km S of Veľké Kapušany), in the flood plain forest, Chrtková A. 1976</td>
<td>100</td>
<td>32</td>
</tr>
<tr>
<td><strong>C. palustris subsp. laeta</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>W Bohemia, in the valley of the brook Železný potok between the mountain Špičák and the village Železná Ruda, Chrtková A. 1977</td>
<td>ca 840</td>
<td>32</td>
</tr>
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<td>57</td>
<td>S Bohemia, draining sewer near the village Záhvozdí near the town Volary, Tomšovic P. 1977</td>
<td>750</td>
<td>32</td>
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<tr>
<td>28</td>
<td>S Bohemia, village Brloh, settlement Kovářov, spring on the N slope of the hill Bulový, Skalický V. 1976</td>
<td>ca 700</td>
<td>32</td>
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<td>89</td>
<td>S Bohemia, village Holubov, wet place in the forest on the S slope of the Klęt Mt, Chrtková A. 1982</td>
<td>ca 900</td>
<td>32</td>
</tr>
<tr>
<td>109</td>
<td>S Bohemia, village Vílvice 5 km NE of the town Mladá Vožice, Slavík B. 1975</td>
<td>480</td>
<td>34</td>
</tr>
<tr>
<td>54</td>
<td>C Moravia, at the town Výškov, Štěpánek J. 1977</td>
<td>ca 240</td>
<td>32</td>
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<td>78</td>
<td>N Moravia, Hrubý Jeseník Mts, the cottage Švýcárná, near the spring in the meadows, Chrtková A. 1980</td>
<td>1300</td>
<td>59</td>
</tr>
<tr>
<td>56</td>
<td>N Moravia, Hrubý Jeseník Mts, Jelení studánka, at the brook on the S slope of the mountain Jelení hřbet, Tomšovic P. 1977</td>
<td>1320</td>
<td>56</td>
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<td>73</td>
<td>N Moravia, Hrubý Jeseník Mts, valley Velká Kotlina, at the brook, Bělohlávková R. 1979</td>
<td>1100</td>
<td>57</td>
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<td>74</td>
<td>N Moravia, Hrubý Jeseník Mts, valley of the rivulet Bílá Opava below the cottage Ovčárna, at the brook on the margin of spruce forest, Chrtková A. 1979</td>
<td>ca 1270</td>
<td>59</td>
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<td>77</td>
<td>N Moravia, Hrubý Jeseník Mts, brook in the valley of the river Bílá Opava in the village Karlova Studánka, Chrtková A. 1979</td>
<td>780</td>
<td>56</td>
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<td>27</td>
<td>N Slovakia, Nízke Tatry Mts, spring of the little brook in the saline meadows near the village Liptovská Lúžna, Fišerová D. 1976</td>
<td>990</td>
<td>32; 58, 57</td>
</tr>
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<td>70</td>
<td>N Slovakia, Vysoké Tatry Mts, in the valley Furkotská dolina below the Solisko Mt, at the brook, Chrtk J. 1979</td>
<td>ca 1850</td>
<td>64</td>
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<td>71</td>
<td>N Slovakia, Vysoké Tatry Mts, near the challet Kežmarská chata, at the lake Biele pleso, Chrtk J. 1979</td>
<td>1600</td>
<td>61</td>
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<td>72</td>
<td>N Slovakia, Vysoké Tatry Mts, Tatranská Lesná, at the brook, Chrtk J. 1979</td>
<td>900</td>
<td>58</td>
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<td>82</td>
<td>N Slovakia, Vysoké Tatry Mts, in the valley Mengušovská dolina, below the lake Popradské pleso, wet meadows, Chrtková A. 1981</td>
<td>ca 1500</td>
<td>59</td>
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<td>83</td>
<td>N Slovakia, Vysoké Tatry Mts, in the valley Mengušovská dolina, in the bottom at the brook, Chrtková A. 1981</td>
<td>1300</td>
<td>56</td>
</tr>
<tr>
<td>85</td>
<td>N Slovakia, Vysoké Tatry Mts, below the lake Popradské Pleso, Chrtková A. 1981</td>
<td>1490</td>
<td>57–59</td>
</tr>
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</table>
86 N Slovakia, Vysoké Tatry Mts, wet meadows near the lake Velké Hincovo pleso, Chrtkova A. 1981
89 N Slovakia, Belianské Tatry Mts, the valley Dolina siedmiach prameňov, in wet places above the cottage Plesniec, Chrtk J. 1979
88 N Slovakia, between villages Závodie and Sulín, alluvium of the river Poprad, Chrtk J. 1982
40 C Slovakia, Slovenský raj, valley of the brook Velka Biela Voda (W of the town Spišská Nová Ves), Šourková M. 1977
41 C Slovakia, Slovenský raj, wet places in the valley Sokolia dolina, Šourková M. 1977
42 C Slovakia, Slovenský raj, valley of the brook Lesnica, Šourková M. 1977
43 C Slovakia, Slovenský raj, valley Zelená dolina, S of the mill Letanovačky mlyn, Šourková M. 1977
84 C Slovakia, Slovenský raj, at the brook near the mill Letanovačky mlyn, Chrtkova A. 1981
79 C Slovakia, Slovenské Rudohorie Mts, village Betliar, at the brook, Chrtkova A. 1979
29 E Slovakia, wet meadows NE of the town Humenné, Chrtk J. 1976
30 N Rumania, Apuseni Mts, in the village Dealul Negru, peat, Chrtkova A. 1976
35 C Rumania, Retezat Mts, brook near the village Nucsoara, Chrtkova A. 1976
31 N Rumania, Maramureşului Mts, on the hill Dealul near the village Borșa, at the brook in the pasture, Chrtkova A. 1976
33 N Rumania, Rodnei Mts, Pietroșul Mt., S of the village Borșa, at the brook near the lake Lezer Pietroșul, Chrtkova A. 1976
34 N Rumania, Rodnei Mts, between Borșa-Hotel and waterfalls Cascada Cailor, brook in the spruce forest, Chrtkova A. 1976

C. palustris subsp. palustris
51 W Bohemia, village Malá Černá Hať nad Střelou (near the town Plzeň), deep valley in the spruce forest, at the brook, Chrtkova A. 1977
52 W Bohemia, in the margins of a little pond at the brook Dobříčský potok near the village Kacefov, NE of the town Plzeň, Chrtkova A. 1977
53 W Bohemia, valley below the castle Libštejn, at the brook (NE of the town Plzeň), 6 km NW of the village Radnice, Chrtkova A. 1977
47 W Bohemia, valley of the brook Dubský potok, below the ruin Krakovec, at the brook, ca 12 km SW of the town Rakovník, Chrtkova A. 1977
20 C Bohemia, between villages Roztoky u Křivoklátu and Bráno, at the brook in the meadows, at the river Berounka, Chrtkova A. 1976
21 C Bohemia, at the brook Rakovnický potok in the meadows in the forest, S of the village Městečko u Křivoklátu, Chrtkova A. 1976
44 C Bohemia, at the pond Bucký rybník, SW of the village Třtice (near the village Nové Strašeci), in Caricetum gracilis, Husák Š. 1977
6 C Bohemia, wet meadows S of the village Zadní Třebáň, Chrtkova A. 1976
7 C Bohemia, on the bank of the brook Svinařský potok near the village Zadní Třebáň, Chrtkova A. 1976
8 C Bohemia, village Zadní Třebáň, on the bank of the brook Svinařský potok under the alders, Chrtkova A. 1976
22 C Bohemia, village Louňovice near the town Říčany, at the pond Louňovický rybník, Chrtkova A. 1976
17 C Bohemia, village Mukařov 5 km E of the town Říčany, little brook in the meadows, Chrtkova A. 1976
Caltha palustris subsp. procumbens

14 W Bohemia, Krušné hory Mts, village Jelení 5 km SE of the village Nové Hamry, at a small brook, Chrtkóva A. 1976
   ca 860 56

45 W Bohemia, margin of little pond near the village Hůrky (ca 22 km NW of the town Plzeň), Chrtkóva A. 1977
   510 56+6B

46 W Bohemia, near the village Hůrky (22 km NW of the town Plzeň), Alnetum, Chrtkóva A. 1977
   510 56

48 W Bohemia, vicinity of the village Manětín, Alnetum, Chrtkóva A. 1977
   ca 450 56

49 W Bohemia, brook in spruce forest near the village Manětín, Chrtkóva A. 1977
   ca 450 57

50 W Bohemia, valley of the river Střela, at the brook near the village Rabštejn nad Střelou (near the town Plzeň), Chrtkóva A. 1977
   450 56

92 S Bohemia, village Slavonice, at the brook in the spruce forest, Chrtkóva A. 1983
   ca 540 56

11 S Bohemia, at the pond Klášterský rybník near the town Nová Bystřice, Šourková M. 1976
   640 56

5 S Bohemia, near the village Albeř, in the wet spruce forest near the pond Kaproun, Slavíková Z. 1976
   ca 600 56

9 S Bohemia, the village Albeř, at the pond Osíka, Šourková M. 1976
   630 56

10 S Bohemia, on the bottom of empty pond Horní rybník near the village Albeř, Šourková M. 1976
   630 56

12 S Bohemia, at the pond below the railway in the village Albeř, Šourková M. 1976
   600 56

13 S Bohemia, peat meadows near the village Albeř, Šourková M. 1976
   ca 600 56
4 S Bohemia, ruins of the castle Landštejn, ca 10 km E of the town Nová Bystřice, at the brook in the spruce forest, Slavíková Z. 1976

560 55

64 E Bohemia, Českomořavská vysočina Highland, at the pond Kaliště'ský rybník, 2 km SW of the village Horní Dubenky, Jeřábková O. 1978

650 56

75 N Moravia, Hrubý Jeseník Mts, the peat-bog Rejvíz, at the brook in the spruce forest, Chrtková A. 1979

ca 740 55

126 N Moravia, Hrubý Jeseník Mts, village Vrbno pod Pradědem, road 1 km E of the village, at the brook, Slavík B. 1977

540 59*

C. palustris intermediate between subsp. laeta and subsp. palustris

59 C Bohemia, at the pond Punčochá, SE of the village Třtíce (near the village Nové Strašecí), Chrtková A. 1977

420 32

25 C Bohemia, margin of the pond SE of the village Srby near the town Kladno, Chrtková A. 1976

380 47

18 C Bohemia, deep valley in the spruce forest N of the town Dobříš, Chrtková A. 1976

400 32

19 C Bohemia, alder forest near the village Trnová near the town Dobříš, Chrtková A. 1976

400 32

38 N Bohemia, village Světlá pod Ještědem, the spring of the river Ploučnice, at SW slopes of Ještěd Mt, Chrtk J. 1977

654 32

66 E Bohemia, between the rock Zaječí skok and the town Jihlava, in wet meadows, Chrtková A. 1978

480 44

* Chromosomes counted by L. Kirschnerová