Hieracium bauhini group in Central Europe: chromosome numbers and breeding systems

Počty chromozómů a způsoby reprodukce jestřábníků ze skupiny *Hieracium bauhini* ve střední Evropě

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Chromosome numbers for 239 plants from 84 localities in the Czech Republic, Slovakia, Hungary, Germany and Poland are given. Most of the populations were pentaploid (2n = 45), while hexaploid (2n = 54) and tetraploid (2n = 36) populations were rarer. A long marker chromosome was observed in plants from 8 pentaploid populations. Tetraploid plants occurred mainly in Slovakia and Hungary. In the Czech Republic and Germany, most populations were pentaploid. Hexaploid populations (2n = 54) were rare but scattered over the entire study area. The co-occurrence of two different cytotypes was documented at 7 sites. Most tetraploids were fully sexual and only a few tetraploid plants from Poland were apomictic; pentaploid and hexaploid plants were apomictic. Two morphotypes of *H. bauhini* were distinguished: tetraploid and hexaploid plants from Slovakia and Hungary, and some hexaploid plants from the Czech Republic were assigned to the *H. magyaricum* group, while tetraploids and hexaploids from the Czech Republic and Poland plus all pentaploids belong to the *H. bauhini* group.

Keywords: *Compositae*, cytogeography, Czech Republic, Germany, Hungary, karyology, ploidy level, Poland, reproduction mode, Slovakia

Introduction

Hieracium subgen. *Pilosella* is divided into two informal species groups, referred to as basic and intermediate. Members of the latter are considered to be of hybrid origin. Large variation in the ploidy level and mode of reproduction was observed in species of both groups. The reasons for this variation are reviewed in detail by Krahulcová et al. (2000). The knowledge of the karyology and breeding systems of *H.* subgen. *Pilosella* vary: some species, such as *H. pilosella* and *H. aurantiacum* are well and others poorly studied.

Studies on the karyology and mode of reproduction in *Hieracium* subgen. *Pilosella* may be divided into three periods. The earliest papers on chromosome numbers and mode of reproduction were published at the beginning of the 20th century by Ostenfeld (1906, 1910) and Rosenberg (1906, 1907, 1917); the latter author was the first to describe the apomixis of aposporic type in this subgenus (Rosenberg 1906, 1907). Further large-scale studies on karyology and mode of reproduction were published during the second half of the last century and dealt in detail with *H. pilosella* (Delcourt 1972, Gadella 1972, 1981, 1982, Pogan & Wcisło 1989) and *H. aurantiacum* (Skalińska 1969, 1970, 1971a, b, c, 1973, 1976). At the turn of the century, a series of karyological papers was written by Schuhwerk & Lippert (1997, 1998, 1999, 2002), followed by studies on karyology and breeding systems of hawkweeds from the Krkonoše Mts, Czech Republic (Krahulcová &

Krahulec 1999, Krahulcová et al. 2001), Central Europe (Rotreklová et al. 2002, 2005) and other European countries (Vladimirov & Szeląg 2001, Mráz & Szeląg 2004). New knowledge on karyology came from studies on invasive hawkweeds populations in New Zealand, namely those of *H. pilosella* (Makepeace 1981, Chapman & Lambie 1999, Jenkins & Jong 1997), which included aneuploid plants for the first time.

The basic chromosome number in this subgenus is x = 9, and seven different ploidy levels (diploid to octoploid) are found in natural populations. There are diploids in most basic species, including *H. pilosella* (Gadella 1984), *H. piloselloides* (Favarger 1971, 1997, Mulligan 1984), *H. echioides* (Skalińska et al. 1976, Schuhwerk & Lippert 1997, Stepanov & Muratova 1995, Peckert in Rotreklová et al. 2002), *H. cymosum* (Javůrková in Měsíček & Jarolímová 1992, Šimek 2000), *H. lactucella* (Rosenberg 1917, Turesson & Turesson 1960, Skalińska 1967, 1968, Skalińska et al. 1968, Gadella et al. 1970, Krahulcová & Krahulec 1999, Rotreklová et al. 2002), and *H. caespitosum* (Skalińska 1967, Kubień in Skalińska et al. 1968, Skalińska & Kubień 1972, Schuhwerk & Lippert 1998, Vladimirov 2000, Krahulcová et al. 2001, Krahulcová in Rotreklová el al. 2002). They reproduce sexually (Gadella 1984, Gadella et al. 1970, Krahulcová & Krahulec 1999, Rotreklová et al. 2002, Skalińska 1967, A. Kubień in Skalińska et al. 1968, Skalińska & Kubień 1972, Krahulcová et al. 2001, Vladimirov 2000). An exception is *H. aurantiacum*, for which diploid plants are obtained only from experimental crosses and are the dihaploid progeny of a tetraploid plant (Skalińska 1971a, Bicknell 1997), which the latter author found to be apomictic. Triploid plants are apomictic or sterile in the wild (Rotreklová et al. 2005) and when produced by experimental hybridization (Skalińska 1969, Gadella 1991, Koltunow et al. 1998). The mode of reproduction of tetraploid basic species varies: sexual reproduction occurs in *H. pilosella*, *H. bauhini*, *H. echioides*, and *H. piloselloides*, whereas *H. aurantiacum* and *H. caespitosum* are apomictic. The situation in intermediate species is different: sexual tetraploids are present only in *H. densiflorum* (Rotreklová in Rotreklová et al. 2002), while other tetraploid intermediate taxa, e.g. *H. tubulascens*, *H. schultesii*, and *H. floribundum*, are apomictic (Krahulcová et al. 2001). Both modes of reproduction, sexual and apomictic, occur in the tetraploid *H. apatelium, H. piloselliflorum* (Krahulcová et al. 2001) and *H. schultesii* (Krahulcová & Krahulec 1999, Krahulcová et al. 2001). Basic and intermediate species with higher ploidy levels (i. e. 5x, 6x, 7x and 8x) are mainly apomictic, except for the pentaploid and hexaploid *H. pilosella,* for which sexual reproduction is recorded (Pogan & Wcisło 1995, Krahulcová in Rotreklová et al. 2002). Recently, sexual reproduction was recorded in the pentaploid *H. echioides* (Peckert in Rotreklová et al. 2005).

Cytogeographic studies were made on some taxa of *Hieracium* subgen. *Pilosella*. In *Hieracium pilosella*, the distribution of particular cytotypes was studied in Sweden (Turesson & Turesson 1960), France (Delcourt 1972), the Netherlands (Gadella 1972, 1981, 1982, 1987, Gadella & Kliphuis 1968), Poland (Pogan & Wcisło 1989) and Slovakia (Pišťanský & Mičieta 2000). The distribution patterns of tetraploids, pentaploids and hexaploids within each country depend on altitude and climate, but in general, tetraploids occur mainly in western, while pentaploids and hexaploids in eastern Europe. Further cytogeographical studies were made on *Hieracium caespitosum* (Skalińska & Kubień 1972) in Poland. Two ploidy levels, which differed in ecology and geography, were detected in *H. caespitosum* in Poland (Skalińska & Kubień 1972). A sexual diploid of *H. caespitosum* ("*H. pratense* subsp. *silvicolum* Zahn") occurs in some habitats in the Białowieża forest in the eastern part of this species' distribution area in Poland, whereas

the apomictic tetraploid of *H. caespitosum* ("*H. pratense* subsp. *eu-pratense* Zahn") occurs in secondary habitats in lowlands or mountains in the W part of Poland. Similar ecological differentiation was found among the various ploidy levels in *H. cymosum*: diploids occur in relict habitats, tetraploids and hexaploids predominantly in secondary grasslands (J. Chrtek jun., in verb.).

The first classification of *Hieracium* subgen. *Pilosella* from Central Europe was that of Nägeli & Peter (1885). It is based on morphological characters. According to these authors, *Hieracium bauhini* ("*H. magyaricum*") and *H. piloselloides* ("*H. florentinum*") are included in *Hieracium* (subgen. *Pilosella*) sect. *Prealtina.* These two species are distinguished by the presence or absence of stolons. The stoloniferous *H. bauhini* is divided into eleven groups, each consisting of many subspecies based on the presence of stolons developing in the axils of stem leaves, stellate hairs on peduncles, and branching of inflorescences. Many of the Nägeli and Peter's subspecies of *H. bauhini* are taxa with small distributions, often restricted to a few localities. A similar treatment was suggested by Zahn (1930) who divided *H. bauhini* into four groups: (1) *H. cryptomastix*, plants with very short stolons, distribution Steiermark and Galicia (historic region, now in SE Poland and W Ukraine); (2) *H. aëristolonum*, plants with stolons growing from both rosette and stem leaves, distribution from south-eastern Europe to Carinthia, Slovenia ("Krain") and Steiermark; (3) *H. magyaricum*, plants with stolons growing only from the rosette and peduncles lacking or with few stellate hairs, distribution mainly SE Europe; and (4) *H. bauhini*, with stolons growing only from the rosette and peduncles with dense stellate hairs, distribution in W Europe. Following this taxonomic division of *H. bauhini*, only *H. bauhini* and *H. magyaricum* groups were detected in the study area.

Detailed studies, especially on basic species, are important for understanding the evolutionary processes in *Hieracium* subgen. *Pilosella* (Krahulec et al. 2004). In this study of *H. bauhini*, (1) the occurrence of diploids, (2) the geographic distribution of plants with particular ploidy levels, and (3) the relationship between ploidy level, mode of reproduction and morphological characters were determined.

Materials and methods

One to six plants from each population were collected from the field between 1996–2002 and cultivated in pots in the Botanical Garden of Masaryk University, Brno, and from 2003 in the Experimental Garden of the Faculty of Education, Masaryk University, Brno-Kejbaly. Root tips of mature plants were used for chromosome counts. They were pretreated at room temperature with a saturated water solution of p-dichlorbenzene for 2 hours and then fixed in a cold mixture of ethanol and acetic acid (3:1) for 24 hours. The fixed material was treated immediately. The root tips were macerated in a mixture of ethanol and hydrochloric acid (1:1) for 2 min at room temperature. Temporary slides were made by squashing the cut and macerated meristems in lacto-propionic orcein.

Flow cytometry was used to detect the ploidy level of 17 plants. A PA-I ploidy analyzer (Partec GmbH, Münster, Germany) equipped with an HBO-100 mercury arc lamp was used for the flow-cytometric detection of relative DNA content. Sample preparations were carried out in a two-step procedure (Otto 1990, Doležel & Göhde 1995) in the Laboratory of Flow Cytometry, the Department of Botany, Masaryk University Brno. The stem tissues

of the test plant and a reference standard (0.5 cm^2 of leaf blade) were chopped with a new razor blade for about 20 s in a Petri dish containing 0.5 ml of ice-cold Otto I buffer (4.2 g citric acid monohydrate + 1 ml 0.5% Tween 20 adjusted to 200 ml and filtered through a 0.22 μm filter), then 0.5 ml more Otto I buffer was added. The solution was filtered through nylon cloth (50 μm mesh size). For DNA staining, 2 ml of Otto II buffer (0.4 M disodium hydrogenphosphate dodekahydrate) including DAPI (4´,6-diamidino-2-phenylindole; 4 μg/ml final concentration) was used. A clone of diploid *Hieracium lactucella* cultivated in the Masaryk University Botanical Garden was used as a reference standard for the relative DNA content measurement.

The breeding system of cultivated plants was determined by comparing the seed set of open-pollinated and emasculated capitula. This procedure is described in detail elsewhere (Gadella 1987, Krahulcová & Krahulec 1999). While the emasculated capitula of sexual plants produce no seed, both the emasculated and open-pollinated capitula of apomictic plants produce seed. However, all types that had well developed seeds in emasculated capitula were classified as apomictic, although apomixis may be facultative: the production of some progeny by sexual reproduction is not excluded. Voucher specimens of all plants are deposited in the herbarium of the Department of Botany of Masaryk University, Brno (BRNU).

Results and discussion

Chromosome numbers

The chromosome numbers of 239 plants of *Hieracium bauhini* from 84 localities in the Czech Republic, Slovakia, Hungary, Poland and Germany were counted. Three ploidy levels were recorded in cultivated plants: tetraploid (2n = 36, 77 plants from 27 populations, Fig. 1c), pentaploid (2n = 45, 116 plants from 43 populations, Fig. 1b, 1d) and hexaploid (2n = 54, 21 plants from 7 populations, Fig. 1a). The pentaploids were the most frequent, and hexaploids and tetraploids are rare. For the list of localities of the plants, see Appendix 2. Tetraploids were found in Germany (Schuhwerk & Lippert 1997, 2002), Greece (Papanicolaou 1984), Slovakia (Mráz in Rotreklová et al. 2002, 2005) and Montenegro (Schuhwerk & Lippert 1998). Pentaploids are the most frequently recorded cytotype in Belgium, the Netherlands (Gadella 1984), Germany (Schuhwerk & Lippert 1997, 2002, Bräutigam & Bräutigam 1996), Slovakia (Uhríková 1970, Mráz in Rotreklová et al. 2005), Romania (Mráz & Szeląg 2004) and the Czech Republic (Krahulcová et al. 2001, Krahulcová and Rotreklová in Rotreklová et al. 2002). Hexaploids are known from Germany (Schuhwerk & Lippert 1997), Macedonia (Schuhwerk & Lippert 1998) and the Czech Republic (Krahulcová in Rotreklová et al. 2002). The tetraploid and pentaploid *H. bauhini* ("*Pilosella prealta* subsp. *thaumasia*"; cf. Sell & West 1977) is recorded in New Zealand (Jenkins & Jong 1996). For a survey of the published chromosome numbers, see Appendix 1. The abundance of the particular cytotypes recorded here is similar to that observed elsewhere (Fig. 2).

In seven populations, two ploidy levels were detected: tetraploids and pentaploids (1 site), tetraploids and hexaploids (1 site), and pentaploids and hexaploids (5 sites, see Appendix 2). All mixed populations occur in open habitats, such as quarries, railway embankments or roadsides. In these habitats, Bräutigam & Bräutigam (1996) and Krahulcová

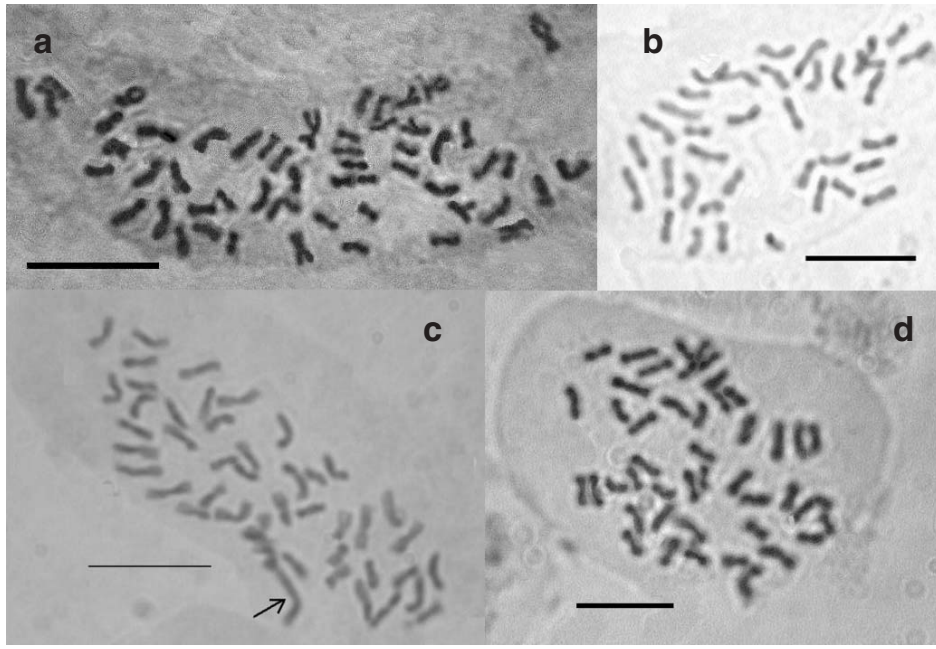

Fig. 1. – Microphotographs of mitotic metaphases of *Hieracium bauhini* – a: 2n = 54, Cz, distr. Hustopeče, Dunajovické kopce Hills, Velká Slunečná Hill (H 98/16); b: 2n = 36, Poland, distr. Warszawa, Kampinos Puscza, Kampinos Górki, (H 01/387)); c: 2n = 45 with a long marker chromosome, Cz, distr. Ústí nad Labem, village Povrly, Kozí hora Hill (H 99/209); d: 2n = 45, Cz, Bílé Karpaty Mts, Starý Hrozenkov (H 01/432). [Scale bars = 10 μm].

et al. (2000) observed hybrid swarms, which showed morphological and karyological variation. Similar variation within populations was found in studies of some other taxa of *Hieracium* subgen. *Pilosella*. In *H. echioides,* for example, the co-occurrence of two or three cytotypes was detected at sites in the southwest of Moravia and an adjacent part of Lower Austria (Peckert in Rotreklová et al. 2002). Chapman & Lambie (1999) recorded four ploidy levels in a New Zealand population of *H. pilosella*. This phenomenon is most frequently encountered in hybridogenous taxa of *Hieracium* subgen. *Pilosella*. Bräutigam & Bräutigam (1996) and Krahulcová (in Rotreklová et al. 2002) recorded karyological variation in *H. brachiatum*, Krahulcová & Krahulec (1999) and Krahulcová et al. (2001) in *H. pilosselliflorum* from the Krkonoše Mts in the Czech Republic.

Marker chromosome

A marker chromosome, which is strikingly larger than the other chromosomes, was observed for the first time in *Hieracium* subgen. *Pilosella* in pentaploid plants of *H. caespitosum* in New Zealand (Jenkins & Jong 1997). Krahulcová (in Krahulcová & Krahulec 1999) found it in some related species from the Krkonoše Mts in the Czech Republic, namely in the tetraploid *H. iseranum, H. floribundum* and *H. caespitosum*, and in both the tetraploid and pentaploid *H. glomeratum*. This long chromosome was later observed in the tetraploid

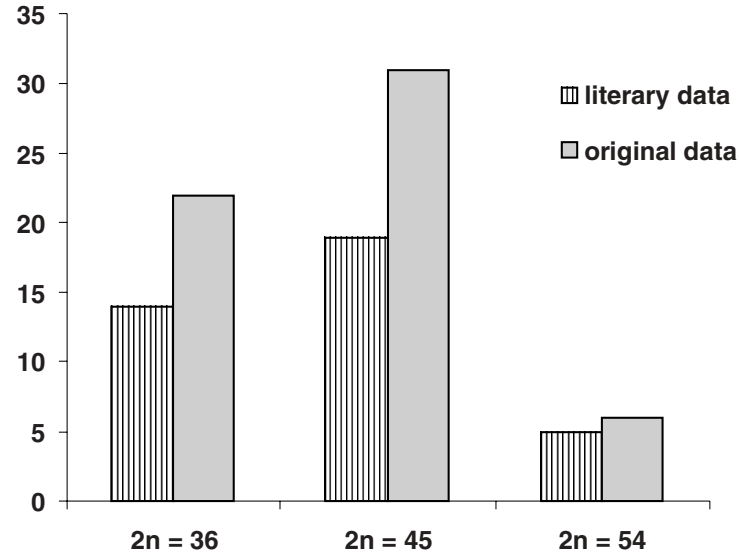

Fig. 2. – Histogram of the abundance of particular cytotypes : data from literature – striped columns (for survey of published chromosome counts see Appendix 1); original data – grey columns (populations in which only one plant was examined and the mixed populations were not included; for survey of localities see Appendix 2).

H. floribundum from other sites in the Czech Republic (Krahulcová in Rotreklová et al. 2002). Recently, the occurrence of a marker chromosome in *H. floribundum* from the Krušné hory Mts was confirmed (Krahulcová in Rotreklová et al. 2005). In *H. bauhini*, it was detected for the first time by Krahulcová (in Krahulcová et al. 2001, Rotreklová et al. 2002). In the course of this study, a marker chromosome was observed in 15 plants from 8 populations of pentaploid *H. bauhini* and in one pentaploid plant from a mixed population (with pentaploid and hexaploid plants) in the Czech Republic (Fig. 1b, for localities see Appendix 2). However, I searched for the marker chromosome in only some of the plants (Appendix 2). No morphological evidence of hybrid origin was observed in samples of *H. bauhinii* with a long marker chromosome.

Relationship between chromosome number and morphological characters

Following Zahn's taxonomical treatment of *H. bauhini* (Zahn 1930), it was possible to distinguish two groups of studied plants (*H. magyaricum* and *H. bauhini*). The tetraploid plants from Slovakia and Hungary belong to the *H. magyaricum* group. These plants have almost glabrous stems, leaves at most with few simple hairs, as well as peduncles and involucral bracts without or with very few stellate hairs, without or with a few glandular or simple eglandular hairs. The rare tetraploid plants from Poland and the Czech Republic, and all pentaploid and hexaploid plants belong to the *H. bauhini* group. Two morphotypes could be distinguished within this group: (a) plants with glabrous stem and leaves, and with peduncles and involucral bracts bearing numerous stellate hairs (white or grey coloured peduncles), and (b) plants with few glandular and single hairs on the stem (numer-

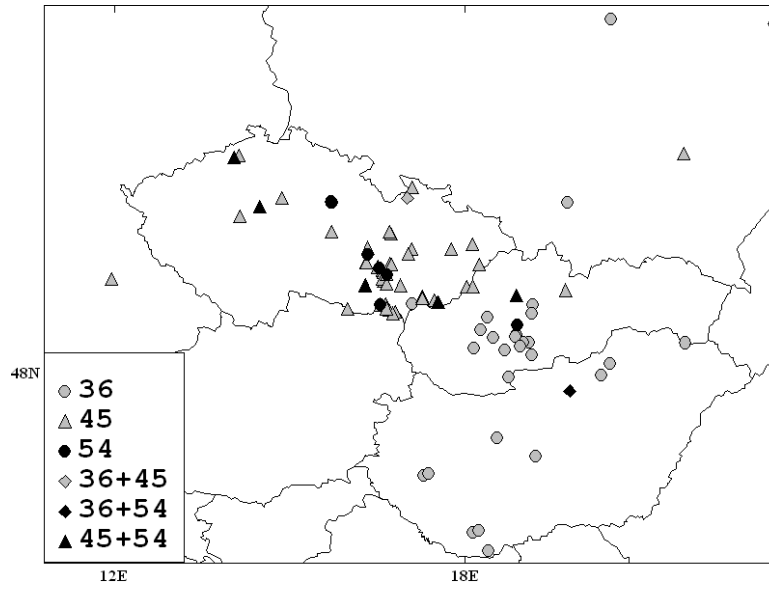

Fig. 3. – Localities of plants of *Hieracium bauhini* agg. in Central Europe that have been investigated karyologically: 2n = 36, grey circle (27 populations); 2n = 45, grey triangle (43 populations); 2n = 54, black circle (7 populations); mixed populations: 2n = 36 and 2n = 45, grey diamond (1 population); 2n = 36 and 2n = 54, black diamond (1 population); 2n = 45 and 2n = 54, black triangle (5 populations). For complete list of localities see Appendix 2.

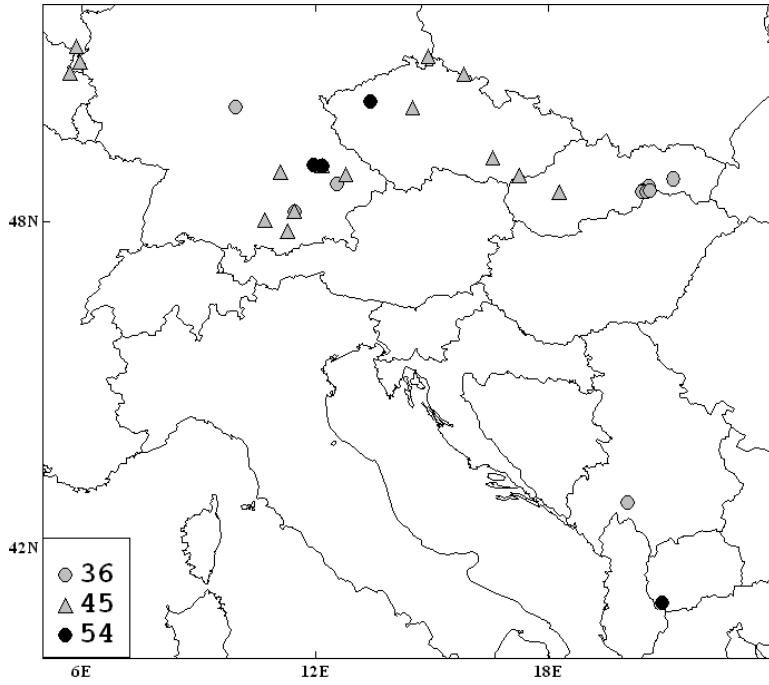

Fig. 4. – Map of the distribution of chromosome counts published for *Hieracium bauhini* agg. from Europe: 2n = 36, grey circle, (11 populations); 2n = 45, black triangle (17 populations); 2n = 54, grey triangle (5 populations). For survey of localities see Appendix 1.

ous on the uppermost part of the stem), and with peduncles and involucral bracts bearing dense stellate and glandular hairs. The distribution patterns and other morphological features of these morphotypes were not distinct, therefore they were not distinguished as Zahn's subspecies.

Cytogeography

The tetraploids are rather more frequent in the eastern part of the study area, namely Slovakia and Hungary, and rare in Poland and the Czech Republic. On the other hand, pentaploids are frequent in the Czech Republic and Germany. The rare hexaploid cytotype is scattered over the entire study area (Appendix 2, Fig. 3). This results corresponds well with the distribution of previous chromosome counts (Uhríková 1970, Gadella 1984, Papanicolaou 1984, Bräutigam & Bräutigam 1996, Schuhwerk & Lippert 1997, 1998, 2002, Krahulcová et al. 2001, Rotreklová et al. 2002, see Appendix 1, Fig. 4). The reverse distribution pattern of particular cytotypes of *H. pilosella* within Europe is described (see Introduction and references therein).

Breeding systems

Both modes of reproduction, sexual and apomictic, were detected. Tetraploid plants reproduce mainly sexually. An exception are tetraploid plants from two populations in Poland, which were apomictic (Appendix 2). On the other hand, pentaploids and hexaploids were apomictic, as were pentaploid plants of *H. bauhini* from Belgium and the Netherlands (Gadella 1984, see Appendix 1). Pentaploid and hexaploid plants in the Czech Republic are apomictic (Krahulcová et al. 2001, Krahulcová and Rotreklová in Rotreklová et al. 2002). A similar relationship between the breeding system and ploidy level is observed in most of the studied plants of *H. pilosella* (Gadella 1984, 1987): tetraploids are sexual, pentaploids apomictic, and hexaploids both sexual and apomictic. There is also a record of pentaploid plants of *H. pilosella* reproducing sexually (Krahulcová in Rotreklová et al. 2002). The relationship between ploidy level and mode of reproduction in other taxa of *Hieracium* subgen. *Pilosella* is mentioned in the Introduction.

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Souhrn

V práci jsou shrnuty výsledky studia chromozómových počtů a způsobů reprodukce jestřábníků z agregátu *Hieracium bauhini*. Chromozómové počty byly zjištěny celkem u 239 rostlin z 84 lokalit z České republiky, Slovenska, Maďarska, Polska a Německa. V souladu s literárními údaji byly u studovaných rostlin zjištěny tři ploidní úrovně: tetraploidní (2n = 36; 77 rostlin z 27 lokalit), pentaploidní (2n = 45; 116 rostlin ze 43 lokalit) a hexaploidní (2n = 54; 21 rostlina ze 7 lokalit). V karyotypu 19 rostlin byl pozorován velký nepárový chromozóm („marker" chro-

mozóm), jehož výskyt byl již dříve pozorován u několika druhů podrodu *Pilosella* včetně *H. bauhini*. Na sedmi lokalitách byl zjištěn společný výskyt rostlin se dvěma různými ploidními úrovněmi. U téměř tří čtvrtin rostlin byly zjišťovány způsoby reprodukce. Tetraploidní rostliny se až na výjimky rozmnožovaly sexuálně, pentaploidní a hexaploidní rostliny výhradně apomikticky. Studované rostliny bylo možno zařadit do dvou geograficky, morfologicky, karyologicky a reprodukčně oddělených skupin. Rostliny z jihovýchodní části studovaného území (tj. ze Slovenska a Maďarska) byly převážně tetraploidní a sexuální. Tyto rostliny měly lodyhy a přízemní listy zcela lysé nebo jen velmi řídce porostlé dlouhými tuhými jednoduchými chlupy; květní stopky a zákrovy bez nebo jen s ojedinělými hvězdovitými chlupy a bez nebo s roztroušeně až hojně se vyskytujícími žlázkami a jednoduchými dlouhými chlupy. Bylo je možno přiřadit ke skupině *H. magyaricum* (Zahn 1930). Rostliny ze severozápadní části studovaného území (tj. z České republiky, Německa, Polska a dvou lokalit na Slovensku) byly pentaploidní nebo hexaploidní (a vzácně, na dvou lokalitách v Polsku, tetraploidní) a rozmnožovaly se apomikticky. Tyto rostliny měly lodyhy a přízemní listy lysé nebo řídce porostlé jednoduchými dlouhými, hvězdovitými i žláznatými chlupy; květní stopky měly hustě porostlé hvězdovitými chlupy (plstnaté), v některých případech i žláznatými a jednoduchými dlouhými chlupy. Tyto rostliny je možné zařadit do skupiny *H. bauhini*. Hranici rozšíření obou skupin ve studovaném území tvoří pravděpodobně pohraniční pohoří mezi Českou republikou a Slovenskem.

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Appendix 1. – List of localities of published chromosome numbers of *Hieracium bauhini* group from Europe.

Source	Locality	2n
Papanicolaou 1984 [“*H. praealtum* subsp. *bauhinii* (Besser) Petunnikov”]	Greece, Mt Athos: from Skiti of Kerasia to Panaghia	36
Jenkins & Jong 1997 (“*Pilosella praealta* subsp. *thaumasia*”)	New Zealand: Craigieburn	36
	New Zealand: The Wolds	36
	New Zealand: Lake Ruataniwha	36
Schuhwerk & Lippert 1997 (“*H. bauhinii* Schult. subsp. *bauhinii*”)	Germany, Bavaria: Unterfranken, Kirchhofberg Hill near Machtilshausen	36
Schuhwerk & Lippert 1998 [“*H. bauhini* subsp. *magyaricum* (Nägeli et Peter) K. Maly”]	Montenegro: meadow slope above Lokve Gate 16 km E of Ivangrad	36
Schuhwerk & Lippert 2002 [“*H. bauhini* Schult. subsp. *thaumasioides* (Nägeli et Peter) Zahn”]	Germany, Bavaria: Oberbayern, München City	36
Schuhwerk & Lippert 2002 [“*H. bauhini* Schult. subsp. *cymanthum* (Nägeli et Peter) Zahn”]	Germany, Bavaria: Niederbayern, Grossköllnbach village	36
Mráz in Rotreklová et al. 2002 (“*H. bauhini* Besser”)	Slovakia, Volovské vrchy Mts, Sitárka Hill	36
Mráz in Rotreklová et al. 2005 (“*H. bauhini* Besser”)	Slovakia, Slovenský kras Mts, Plešivecká planina plateau: Plešivec town, ca. 3.5 km NNE from the railway station Plešivec	36
	Slovakia, Slovenský kras Mts, Silická planina plateau: Silická Brezová village, ca. 0.2 km SE from cote Delené	ca. 36

	Slovakia, Slovenský kras Mts, Silická planina plateau: Brzotín village, Brzotínska skala Hill, ca. 2 km SSE of the village	36
	Slovakia, Rožňavská kotlina basin: Krásnohorské Podhradie village, W slopes of the castle hill Krásna Hôrka	36
	Slovakia, Čierna hora Mts, Košice city: part Kavečany, in the area of Zoological garden	36
Gentschef 1937 [“*H. praealtum* (Vill.) Nägeli et Peter”]	unknown origin, plant from the botanical garden	45
Uhríková 1970 (in Májovský et al. 1970)	Slovakia, Zlatnická dolina Lowland: near Skalica	45
Gadella 1984 [“*H. praealtum* subsp. *bauhinii* (Besser) Petunnikov in Syreistschikov”]	Netherlands, Limburg: Terziet	45
	Netherlands, Limburg: Brunssum	45
	Belgium, Liège: near Visé	45
	Belgium, Liège: Oud Vroenhoven near Albertkanaal	45
Bräutigam & Bräutigam 1996 (“*H. bauhinii* Schult. subsp. *bauhinii* s.l.”)	Germany, Saxonia: 12 km SSW of Görlitz, near the village Schönau-Berzdorf, 4 km W of the border with Poland	45
Jenkins & Jong 1997 (“*Pilosella praealta* subsp. *thaumasia*”)	New Zealand: Mt John trial site	45
	New Zealand: SW face of Mt John	45
Schuhwerk & Lippert 1997 (“*H. bauhinii* Schult. subsp. *bauhinii*”)	Germany, Bavaria: Oberbayern, München-Allach/Karlsfeld	45
(“*H. bauhinii* Schult. subsp. *bauhinii*”)	Germany, Bavaria: Oberbayern, Seeshaupt	45
(“*H. bauhinii* Schult. subsp. *bauhinii*”)	Germany, Bavaria: Oberbayern, Schernfeld	45
Schuhwerk & Lippert 1997 [“*H. bauhinii* subsp. *pseudobauhinii* (Nägeli et Peter) Zahn”]	Germany, Bavaria: Oberpfalz, Mittelberg Hill N of Tegenheim	45
Krahulcová in Rotreklová et al. 2002 (“*H. bauhini* Besser”)	Czech Republic, Praha, town district Vysočany	45
Rotreklová in Rotreklová et al. 2002 (“*H. bauhini* Besser”)	Czech Republic, Brno, Nature reserve Kamenný kopec	45
Krahulcová et al. 2001 (“*H. bauhini* Besser”)	Czech Republic, Krkonoše Mts, Dolní Malá Úpa	45
Schuhwerk & Lippert 2002 [“*H. bauhini* subsp. *thaumasioides* (Nägeli et Peter) Zahn”]	Germany, Bavaria, Niederbayern, Welchenberg	45
	Germany, Bavaria: Oberpfalz, Lauterachtal bei Lauterach	45
P. Mráz in Rotreklová et al. 2005 (“*H. bauhini* Besser”)	Slovakia, Tríbeč Mts: Klátová Nová Ves village	ca. 45
Mráz & Szeląg 2004 [“*Pilosella bauhinii* (F. W. Schultz ex Besser) Arv.-Touv.”]	Romania, Hargitha Mts, Băile Tuşnad, Mt. Piatra Şoimului	45
Schuhwerk & Lippert 1997 (“*H. bauhinii* Schult. subsp. *bauhinii*”)	Germany, Bavaria: Etterzhausen near Nittendorf	54
(“*H. bauhinii* Schult. subsp. *bauhinii*”)	Germany, Bavaria: Regensburg, Keilberg Hill	54
(“*H. bauhinii* Schult. subsp. *bauhinii*”)	Germany, Bavaria: Gemeinde Tegernheim, slope of Mittelbergs Hill	54
Schuhwerk & Lippert 1998 [“*H. bauhini.* subsp. *filiferum* (Tausch) Zahn”]	Macedonia, Ohridsee, Galicica, between Trpezjca and Otesevo	54
A. Krahulcová in Rotreklová et al. 2002 (“*H. bauhini* Besser”)	Czech Republic, distr. Louny, village of Valov	54

Appendix 2. – Chromosome numbers and mode of reproduction of the representatives of *Hieracium bauhini* group from the Central Europe. Number under which the plant is cultivated is given in the first column. When ploidy level was detected by flow cytometry, occurrence of a long marker chromosome was not studied. Abbrevations: Cz = Czech Republic, Sk = Slovakia, Hu = Hungary, O. R. = Olga Rotreklová, p. = plant or plants, FC = flow cytometry, M = long marker chromosome, M+ = karyotyp with a long marker chromosome, M- = karyotyp without a long marker chromosome, apo = apomictic reproduction, sex = sexual reproduction.

Number	Locality	Coordinates	2n	Reproduction
98/122-125, 01/460, 461	Sk, distr.: SW slope of the Tarbucka Hill 2.5 km SE of the village of Streda nad Bogrodom, 160 m a.s.l., coll. J. Chrtek jun., T. Peckert & J. Škorničková, 26 June 1998.	48°23'08"N 21°45'16"E	36 (6 p.) M- presence M studied in 3 p. only	sex (6 p.)
98/135, 136,138	Sk, Strážovské vrchy Mts: slope above the road in the W margin of the village Dolné Vestenice, 230 m a.s.l., coll. J. Chrtek jun., T. Peckert & J. Škorničková, 27 June 1998.	48°42'00"N 18°23'00"E	36 (2 p.) M-	sex (1 p.)
01/391-395	Sk, Banská Štiavnica, slope along the road to quarry 0.5 km NW of the church in the village Jergištoľna, 730 m a.s.l., coll. O. R., 28 June 2001.	48°29'09"N 18°52'36"E	36 (4 p.) M-	sex (3 p.)
01/396-400	Sk, Banská Štiavnica: on the SW margin of the town 0.8 km NE of the top of Vtáčnik Hill, 750 m a.s.l., coll. O.R., 28 June 2001.	48°27'47"N 18°52'01"E	36 (4 p.) M- 4x detected by FC (1 p.)	sex (5 p.)
01/407-409	Sk, Banská Bystrica: slope in the town district Podlavice (NW margin of the town) above the road to the hospital, 470 m a.s.l., coll. O. R., 26 June 2001.	48°44'33"N 19°08'21"E	36 (3 p.) M-	sex (3 p.)
01/421, 423-425	Sk, Veľká Fatra Mts: Donovaly, along the hiking path between villages Donovaly and Špania dolina, 1 km WSW of the Hrubý vrch Hill, 900 m a.s.l., coll. O. R. & Z. Lososová, 26 June 2001.	48°51'00"N 19°09'00"E	36 (4 p.) M-	sex (4 p.)
02/504-506	Sk, distr. Nitra: Krnča, W slope of Kozlica Hill, 450 m a.s.l., coll. O. R. & P. Eliáš jun., 6 September 2002.	48°33'00"N 18°16'00"E	36 (3 p.), M-	sex (3 p.)
02/509	Sk, distr. Nitra: Pohranice, SW slope of the Kolíňanský vrch Hill, 270 m a.s.l., 6 September, coll. O. R. & P. Eliáš jun.	48°19'00"N 18°09'00"E	36 (1 p.), M-	sex (1 p.)
02/523-526	Sk, Vtáčnik: Nature reserve Včelár 6 km NE of the village Topoľčianky, 390 m a.s.l, coll. P. Šmarda, 24 May 2002.	48°27'01"N 18°28'42"E	36 (3 p.) M-, 4x (1 p.) detected by FC	sex (3 p.)
02/527-529, 538, 540, 541	Sk, distr. Krupina: 4.6 km NNE of the village, 450 m a.s l., coll. P. Šmarda, 24 May 2002.	48°23'46"N 19°05'25"E	36 (5 p.) M-, 4x (1 p.) detected by FC	sex (5 p.)
02/530, 531	Sk, Nature reserve Štiavnické vrchy: 1.4 km ESE of the church in the village Žibritov, 460 m a.s.l., coll. P. Šmarda, 22 May 2002.	48°23'12"N 18°59'58"E	36 (1 p.) M-, 4x (1 p.) detected by FC	sex (1 p.)
02/532, 534	Sk, distr. Levice: Nová Dedina, near the Gyndovo Hill, 250 m a.s.l., coll. P. Šmarda, 24 May 2002.	48°17'58"N 18°40'20"E	36 (2 p.) M-	sex (1 p.)
02/535-537	Sk, Krupinská planina: 2.7 km SSW of the church in the village Cerovo, 380 m a.s.l, coll. P. Šmarda 22 May 2002.	48°14'05"N 19°08'03"E	36 (3 p.) M-	sex (2 p.)
02/542-544	Sk, Krupinská planina: Nature Reserve Šipka along the village Plášťovce, 233 m a.s.l., coll. P. Šmarda, 21 May 2002.	48°09'43"N 18°59'01"E	36 (3 p.) M-	sex (1 p.)

02/545-548	Sk, Krupinská planina, Hontianske Nemce-Tepličky: 3.1 km SSE of the setlement Tepička, 260 m a.s.l., coll. P. Šmarda & J. Ripka, 22 May 2002.	48°18'13"N 18°58'03"E	36 (3 p.) M-, 4x (1 p.) detected by FC	sex (4 p.)
98/140-142	Hu, Bükk Mts: rocks along the road 3 km S of the village Mályinka (ca 20 km WNW of the town Miskolec), coll. J. Chrtek, T. Peckert & J. Škorničková, 25 June 1998.	48°08'00"N 20°29'00"E	36 (3 p.) M-	sex (3 p.)
00/303, 305, 306	Hu, village of Pákozd, hills NW of the village, coll. P. Šmarda & T. Vymyslický, 23 June 2000.	47°13'46"N 18°32'43"E	36 (1 p.) M- 4x detected by FC (2 p.)	sex. (2 p.)
02/564	Hu, Pécs-Misina: hill on the N margin of the town, coll. P. Šmarda, 8 June 2002.	46°05'23"N 18°14'02"E	36 (1 p.) M-	not studied
02/568–570	Hu, Zala county, Balaton Lake, Nature reserve Keszthelyi hegység cca. 2 km NW of the village Gyenesdiás,160 m a.s.l., coll. P. Šmarda, 8 June 2002.	46°46'13"N 17°18'03"E	36 (3 p.) M-	sex. (2 p.)
02/571–574	Hu, Zala county, Balaton Lake, Nature reserve Keszthelyi hegység, slope along the village Becehegy, 270 m a.s.l., coll. P. Šmarda, 2 June 2002.	46°47'36"N 17°22'07"E	36 (2 p.) M- 4x (2 p.), detected by FC	sex. (1 p.)
02/575, 576	Hu, Szarvaskö, 340 m a.s.l., coll. P. Šmarda, 8 June 2002.	47°59'32"N 20°19'50"E	36 (2 p.) M-	sex. (2 p.)
02/580, 581	Hu, Baranya county, Mecsek, Nature reserve on the SW margin of the village Cserkút, 250 m a.s.l., coll. P. Šmarda, 8 June 2002.	46°04'17"N 18°08'01"E	36 (2 p.) M-	sex. (2 p.)
02/583	Hu, between villages of Kuntszentmiklós and Kunadacs, steppe, 104 m a.s.l., coll. P. Šmarda, 6 June 2002.	47°00'05"N 19°12'24"E	36 (1 p.) M-	not studied
02/585, 586	Hu, Villányi hegység, Baranya county, Nature reserve along the village Szársomlyó, 200 m a.s.l., coll. P. Šmarda, 7 June 2002.	45°51'07"N 18°24'12"E	36 (2 p.) M-	sex. (2 p.)
01/452	Cz, distr. Hodonín, Dúbrava Forest 2 km WNW of the railway station Hodonín, 165 m a.s.l., coll. R. Řepka, July 2001.	48°51'35"N 17°05'37"E	36 (1 p.) M-	not studied
00/292	Poland, distr. Kraków, village Nawojowa Gora, quarry along the road Krzeszowice-Krakow ca. 0.8 km NW of the church in the village, 280 m a.s.l., coll. O. R. & J. Rotrekl, 16 June 2000.	50°06'01"N 19°45'00"E	36 (1 p.) M-	apo (1 p.)
01/386, 387	Poland, distr. Warszawa, Kampion Puscza, Kampinos Górki, coll. M. Chytrý, 8 June 2001.	52°20'23"N 20°29'30"E	36 (2 p.) M-	apo (1 p.)
98/13	Cz, distr. Vyškov: meadow in the SE part of the village Kobeřice, 320 m a.s.l., coll. Z. Lososová, 6 June 1998.	49°05'22"N 16°53'25"E	45 (1 p.) presence M not studied	not studied
98/23-26	Cz, distr. Brno: along the railway 0.5 km W of the village Přízřenice, 210 m a.s.l., coll. O. R., 25 May 1998.	49°08'45"N 16°36'25"E	45 (4 p.) presence M not studied	apo (2 p.)
98/27	Cz, distr. Zlín: village Bylnice, Na stráži meadow in the NW margin of the village, 340 m a.s.l., coll. M. Chytrý, 24 May 1998.	49°04'34"N 18°01'21"E	45 (1 p.) presence M not studied	not studied
98/28-31	Cz, Brno: along the railway in the town district Obřany, 250 m a.s.l., coll. O. R., 27 May 1998.	49°13'31"N 16°39'10"E	45 (4 p.) presence M not studied	apo (2 p.)

98/34-37	Cz, distr. Žďár nad Sázavou: slope along the railway 1.5 km W of the village of Řikonín, 400 m a.s.l., coll. O. R. & Z. Lososová, 29 May 1998.	49°21'59"N 16°18'09"E	45 (2 p.), ca. 45 (1 p.) presence M not studied	apo (3 p.)
98/38-40	Cz, distr. Žďár nad Sázavou: railway station in the village Řikonín, 390 m a.s.l., coll. O. R. & Z. Lososová, 29 May 1998.	49°21'56"N 16°18'30"E	45 (3 p.) presence M not studied	apo (1 p.)
98/41-44	Cz, Brno: along the forest road in the E margin of the village Mokrá Hora, 250 m a.s.l., coll. O. R., 31 May 1998.	49°15'26"N 16°35'49"E	45 (4 p.) presence M not studied	apo (4 p.)
98/47, 49,50	Cz, Brno: along the road in the town district Bohunice, 250 m a.s.l., coll. O. R., 4 June 1998	49°10'19"N 16°35'16"E	45 (3 p.) presence M not studied	apo (1 p.)
98/55-58	Cz, Brno: railway station Brno-Řečkovice, 240 m a.s.l., coll. O. R., 9 June 1998.	49°14'56"N 16°35'65"E	45 (3 p.) M– presence M studied in 1 p. only	apo (1 p.)
98/63-65	Cz, distr. Blansko: limestone rocks 1 km NE of the village of Rudice, 500 m a.s.l., coll. O. R. & Z. Lososová, 17 June 1998.	49°20'42"N 16°44'06"E	45 (3 p.) presence M not studied	apo (3 p.)
98/76-79	Cz, distr. Prostějov: quarry in the Vápenice Hill 1.7 km NNE of the village Čelechovice na Hané, 290 m a.s.l., coll. O. R., 22 July 1998.	49°31'52"N 17°05'06"E	45 (3 p.) presence M not studied	apo (2 p.)
98/80,83	Cz, distr. Brno: slope above the railway 1 km NE of the village Ivanovice, 280 m a.s.l., coll. O. R., 20 July 1998.	49°16'23"N 16°34'51"E	45 (2 p.) presence M not studied	apo (2 p.)
98/85-87	Cz, Brno: rocky slope 1 km SE of the railway station Brno-Řečkovice, 250 m a.s.l., coll. O. R., 20 July 1998.	49°14'56"N 16°35'65"E	45 (3 p.) M- presence M studied in 1 p. only	apo (3 p.)
98/88-91	Cz, distr. Prostějov: Nature reserve Čubernice 0.5 km NE of the town Plumlov, 310 m a.s.l., coll. O. R., 21 July 1998.	49°28'25"N 17°01'18"E	45 (3 p.), ca. 45 (1 p.) presence M not studied	apo (3 p.)
98/92-95	Cz, distr. Svitavy: quarry 0.5 km N of the town Městečko Trnávka, 340 m a.s.l., coll. O. R., 30 July 1998.	49°43'05"N 16°43'29"E	45 (4 p.) presence M not studied	apo (4 p.)
98/96, 98, 99	Cz, distr. Svitavy: S slope of the Horka hill 0.5 km SW of the village Rozstání, 360 m a.s.l., coll. O. R., 30 July 1998.	49°44'25"N 16°42'11"E	45 (3 p.) M- presence M studied in 1 p. only	not studied
98/100, 102	Cz, distr. Hodonín: slope above the railway station in the town Velká nad Veličkou, 390 m a.s.l., coll. O. R. & J. Rotreklová, 4 August 1998.	48°53'03"N 17°31'51"E	45 (2 p.) presence M not studied	apo (1 p.)
98/108-110	Cz, distr. Hodonín: slope along the railway in the N margin of the village Lipov, 250 m a.s.l., coll. O. R. & J. Rotreklová, 4 August 1998.	48°54'42"N 17°28'17"E	45 (3 p.) presence M not studied	apo (1 p.)
98/143, 144	Cz, distr. Blansko: slope above the N margin of the village Lažánky, 320 m a.s.l., coll. J. Škorničková, 16 June 1998.	49°21'15"N 16°42'36"E	45 (1 p.) M+	not studied
99/149	Cz, distr. Brno: Čebínka Hill 2.5 km ENE of the church in the village Čebín, 330 m a.s.l., coll. M. Kočí, 13 June 1999.	49°18'49"N 16°30'32"E	45 (1 p.) presence M not studied	not studied

99/181, 183-186	Cz, distr. Nymburk: S slope of the Semická hůra Hill 5 km SSE of the town Lysá nad Labem, 210 m a.s.l., coll. O. R., M. Chytrý & P. Šmarda, 29 May 1999.	50°09'31"N 14°51'55"E	45 (5 p.) M+ presence M studied in 3 p. only	apo (1 p.)
99/169, 173	Cz, distr. Znojmo: forest margin 1.25 km NWN of the church in the village Hnanice, 290 m a.s.l., coll. O. R., 25 May 1999.	48°48'01"N 15°59'27"E	45 (2 p.) presence M not studied	apo (1 p.)
99/176, 177	Cz, distr. Břeclav: railway station Valtice, 190 m a.s.l., coll. J. Danihelka, May 1999.	48°44'54"N 16°45'41"E	45 (2 p.) presence M not studied	not studied
99/158-160	Cz, distr. Hodonín: forest 2 km S of the church in the village Bzenec, 200 m a.s.l., coll. Z. Lososová, May 1999.	48°57'19"N 17°15'51"E	45 (3 p.) M+ presence M studied in 1 p. only	apo (1 p.)
99/200, 202-204	Cz, distr. Beroun: sand pit 1 km SE of the church in the village Srbsko, 310 m a.s.l., coll. O. R., 21 June 1999.	49°56'08"N 14°09'00"E	45 (4 p.) M- presence M studied in 1 p. only	apo (3 p.)
99/209-211	Cz, distr. Ústí nad Labem: W slope of the Kozí hora Hill 1.8 km NW of the railway station Povrly, 220 m a.s.l., coll. O. R., 22 June 1999.	50°40'34"N 14°07'57"E	45 (3 p.) M+ presence M studied in 2 p. only	apo (3 p.)
99/224, 226-228	Cz, distr. Havlíčkův Brod: in the slope 0.5 km SE of the chapel in the village Libice nad Doubravou, 480 m a.s.l., coll. O. R., 29 June 1999.	49°44'35"N 15°42'52"E	45 (4 p.) M+ presence M studied in 1 p. only	apo (4 p.)
99/235, 236, 238, 239	Cz, distr. Nový Jičín: Štramberk, Kamenárka quarry 0.75 km SE of the church in the town, 450 m a.s.l., coll. J. Danihelka, 7 July 1999.	49°35'29"N 18°07'15"E	45 (4 p.) M-	apo (4 p.)
99/242	Cz, distr. Brno: nature reserve Velké Drúžďavy 1.4 km NE of the village of Rebešovice, 240 m a.s.l., coll. T. Vymyslický, June 1999	49°06'43"N 16°39'14"E	45 (1 p.) presence M not studied	not studied
99/244-248	Cz, distr. Přerov: quarry 0.8 km E of the chapel in the town of Teplice nad Bečvou, 300 m a.s.l., coll. O. R., 19 August 1999	49°31'46"N 17°45'41"E	45 (5 p.) M+	apo (4 p.)
00/254, 255	Cz, distr. Břeclav: limestone quarry 1.4 km ENE of the church in the village of Perná, coll. O. R., 6 July 2000	48°51'20"N 16°38'25"E	45 (2 p.) presence M not studied	not studied
00/264-268	Cz, distr. Vsetín: strand of the water reservoir Stanovice 1.2 km SW of the railway station Karolinka, m a.s.l., coll. K. Ehrenbergerová, 21 May 2000.	49°20'24"N 18°14'16"E	45 (4 p.) M- 5x (1 p.) detected by FC	apo (2 p.)
00/343	Cz, distr. Břeclav: meadow along the Aloch stream near the fishpond Aláh III 3.6 km SSW of the church in the village Lednice, 170 m a.s.l., coll. J. Danihelka, 21 September 2000.	48°46'09"N 16°47'52"E	45 (1 p.) presence M not studied	apo (1 p.)
01/375	Cz, distr. Hodonín: sandy place 3.3 km SW of the railway station Bzenec-přívoz, 190 m a.s.l., coll. J. Danihelka, June 2001.	48°55'44"N 17°15'58"E	45 (1p.) M-	not studied
99/221	Cz, Rychlebské hory Mts: quarry in the W part of the village of Vápenná, 500 m a.s.l., coll. O. R., 28 June 1999.	50°17'00"N 17°05'25"E	45 (1 p) M+	not studied
99/198, 199	Cz, distr. Žďár nad Sázavou, strand of the water reservoir Vír II. 1 km SE of the village Vír, 350 m a.s.l., coll. O. R. & Z. Lososová, 18 June 1999.	49°33'00"N 16°20'05"E	45 (1 p.) M+	apo (1 p.)

02/464	Cz, distr. Břeclav: Sedlec, Liščí vrch Hill 1.5 km NNW of the church in the village, 250 m a.s.l., coll. O. R. & J. Danihelka, 21 May 2002.	48°47'33"N 16°41'32"E	45 (1 p.) M-	apo (1 p.)
02/468-470	Cz, distr. Břeclav: Dunajovické kopce, Jánská hora Hill 3.25 km W-WNW of the church in the village Dolní Dunajovice, 260 m a.s.l., coll. O. R. & J. Danihelka, 21 May 2002.	48°51'26"N 16°33'04"E	45 (4 p.) M-	apo. (2 p.)
02/489	Cz, distr. Břeclav: Mikulov town, quarry on the NE foot of the Svatý kopeček Hill, 300 m a.s.l., coll. O. R. & J. Danihelka, 21 May 2002.	48°48'33"N 16°39'13"E	45 (1 p.) M-	not studied
01/426, 429	Sk, Biele Karpaty Mts: village of Vršatské Podhradie, along the road 200 m NW of the Vršatec hill, 737 m a.s.l., coll. O. R. & Z. Lososová, 25 June 2001.	49°04'39"N 18°07'39"E	45 (2 p.) M-	apo (1 p.)
01/440-445	Sk, Liptovský Hrádok: bank of the Biely Váh River 200 m E of the confluence of rivers Biely Váh and Belá, 650 m a.s.l., coll. O. R., 14 July 2001.	49°01'54"N 19°42'40"E	45 (6 p.) M-	apo (3 p.)
00/317, 318	Germany, Bavaria: 8 km NE of the Kallmünz, Greinhof, coll. O. R. & P. Šmarda, 11 July 2000.	49°10'00"N 11°57'00"E	45 (1 p.) M- 5x (1 p.) detected by FC	apo (2 p.)
01/463	Poland: Sandomierz village, Góry Peprzowe, slope above the Wisła River E of the town, coll. J. Chrtek jun., Z. Szeląg & T. Peckert 11 June 2001.	50°41'41"N 21°44'00"E	45 (1 p.) M-	apo (1 p.)
99/214, 216	Cz, Jeseníky Mts, distr. Šumperk: Branná, limestone quarry in the E margin of the town, 600 m a.s.l., coll. O. R., 28 June 1999. Plants occur together with *H. piloselloides*.	50°09'13"N 17°00'36"E	36 (1 p.), 45 (1 p.), both ploidy level M-	apo (both ploidy level)
02/567, 577, 578	Hu, Heves county, Gyöngös: rocky slope along the town, 270 m a.s.l., coll. P. Šmarda, 4 June 2002.	47°47'50"N 19°47'21"E	36 (2 p.) M- 54 (1 p.) M-	sex (36–2 p.), apo (54–1 p.)
98/104, 105-107	Cz, distr. Hodonín: slope alon the road 1 km NE of the church in the town Velká nad Veličkou, 400 m a.s.l., coll. O. R. & J. Rotreklová, 3 August 1998.	48°53'08"N 17°31'57"E	45 (3 p.) M– presence M studied in 1 p. only, 54 (1 p.) presence M not studied	both ploidy level apo (45–3 p., 54–1 p.)
99/205–206	Cz, distr. Ústí nad Labem: between road and railway 0.75 km SE of the railway station Ústí nad Labem, 140 m a.s.l., coll. O. R., 22 June 1999.	50°39'11"N 14°02'48"E	45 (1 p.) M+ 6x (1 p.) detected by FC	both ploidy level apo
01/354-358, 361	Cz, distr. Brno: nature reserve Nad řekami 850 m SSE of the church in the village of Biskoupky, 260 m a.s.l., coll. O. R. & Z. Lososová, 18 May 2001.	49°05'33"N 16°17'21"E	45 (3 p.) M- 54 (1 p.) M-	apo (45–3 p., 54 – not studied)
01/432, 434-436	Cz, Bílé Karpaty Mts: quarry 1 km NNE of the church in the village of Starý Hrozenkov, 460 m a.s.l., coll. O. R. & Z. Lososová, 25 June 2001.	48°58' 08"N 18°52'26"E	45 (3 p.) M- 54 (1 p.) M-	both ploidy level apo (45–3 p., 54–1 p.)
02/498, 515, 517-519	Cz, Praha, town district Spořilov, road margin of the Jižní spojka, near a brigde Hlavní Street, 250 m a.s.l., coll. J. Chrtek jun., 6 May 2002.	50°02'47"N 14°29'20"E	45 (1 p.) M- 54 (4 p.) M-, 6x (1 p.) detected by FC	apo (45–1 p., 54 – not studied)
98/59-61	Cz, distr. Hradec Králové: strand of the fish-pond 2.9 km N of the croassroad in the village Hrádek, 220 m a.s.l., coll. J. Danihelka, June 1998.	50°05'59"N 15°43'28"E	54 (3 p.) M- presence M studied in 1 p. only	apo (3 p.)

01/370-374	Cz, distr. Hradec Králové: strand of the fish-pond 2.9 km N of the croassroad in the village Hrádek, 220 m a.s.l., coll. J. Danihelka, June 2001.	50°06'19"N 15°43'01"E	54 (4 p.) M-	apo (4 p.)
98/115-117	Cz, distr. Žďár nad Sázavou: slope above the bank of the Svratka River 1.5 km NNE of the church in the village Nedvědice, 330 m a.s.l., coll. O. R., 11 August 1998.	49°28'02"N 16°20'35"E	54 (2 p.), (6x) (1 p.) detected by FC presence M not studied	apo (2 p.)
98/51-53	Cz, distr. Brno: railway station in the village Kuřim, 290 m a.s.l., coll. O. R., 9 June 1998.	49°18'04"N 16°32'01"E	54 (3 p.) presence M not studied	apo (3 p.)
98/19-22	Cz, Brno: quarry Hády in the NE part of the town, 400 m a.s.l., coll. O. R., 22 May 1998.	49°13'12"N 16°40'16"E	54 (4 p.) M-presence M studied in 1 p. only	apo (4 p.)
98/16	Cz, distr. Hustopeče: Nature reserve Dunajovické kopce 2 km W of the village Dunajovice, W slope of the Velká Slunečná Hill, 230 m a.s.l., coll. J. Danihelka, June 1997.	48°51'10"N 16°33'08"E	54 (1 p.) presence M not studied	not studied
01/412, 413, 415	Sk, Žiar nad Hronom: village of Stará Kremnička, quarry 3 km N of the church in the village, 500 m a.s.l., coll. O. R., 28 June 2001.	48°36'15"N 18°54'00"E	6x, (3 p.) detected by FC	apo (3 p.)