Evolutionary processes shaping the genus *Urtica* L. (Urticaceae) in Europe and adjacent areas

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Evoluční procesy formující rod *Urtica* L. (Urticaceae) v Evropě a přilehlých oblastech

Evolutionary processes shaping the genus *Urtica* L. (Urticaceae) in Europe and adjacent areas

Disertační práce / Doctoral thesis

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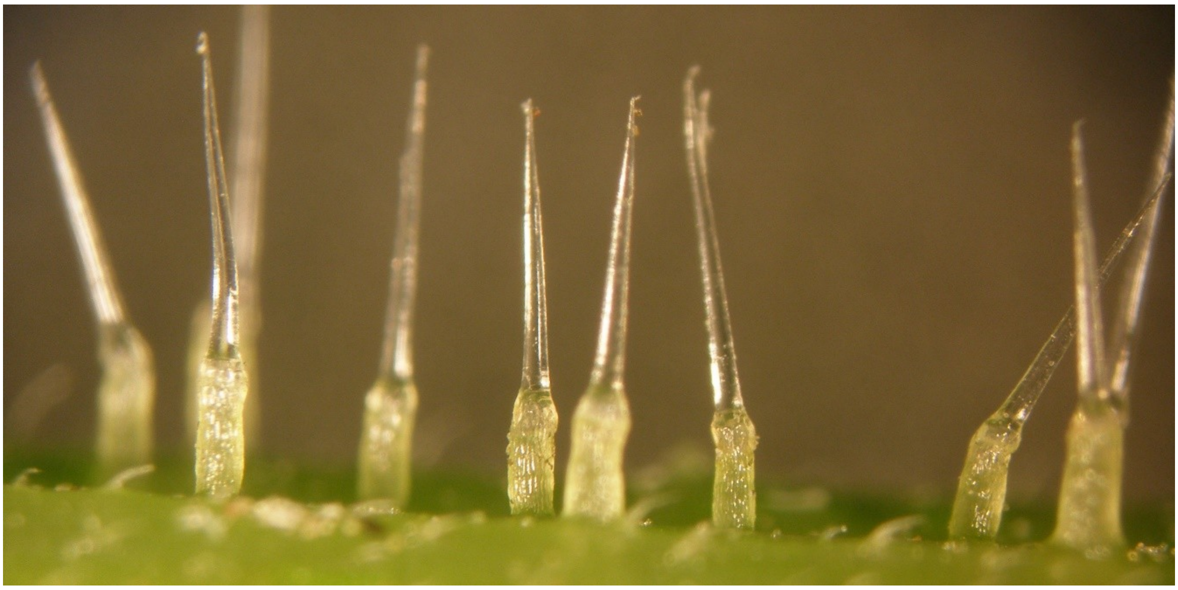
Dedicated to everyone who does not sting



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Prohlašuji, že jsem disertační práci zpracovala samostatně a že jsem uvedla všechny použité informační zdroje a literaturu. Tato práce ani její podstatná část nebyla předložena k získání jiného nebo stejného akademického titulu.

AUTHOR'S DECLARATION

I hereby declare that I have made this dissertation thesis independently and that I have stated all the used information sources and references. Neither this work nor a significant part of it has been used to obtain any other academic degree or diploma.

Ludmila Rejlová

AUTHOR CONTRIBUTION STATEMENT

I hereby declare that I have substantially contributed to all articles included in the thesis. My contributions to the articles are as follows:

I. **Rejlová L.**, Chrtek J., Trávníček P., Lučanová M., Vít P., Urfus T. (2019) Polyploid evolution: The ultimate way to grasp the nettle. Plos One 14: e0218389.

study design, field sampling, data analyses, plant cultivation, lab work, manuscript writing, and preparation – total contribution 70%

II. **Rejlová L.**, Böhmová A., Chumová Z., Hořčicová Š., Josefiová J., Schmidt P.-A., Trávníček P., Urfus T., Vít P., Chrtek J. (2021) Disparity between morphology and genetics in *Urtica dioica* (Urticaceae). Botanical Journal of the Linnean Society 195: 606–621.

study design, field sampling, data measurement, data analyses, manuscript writing, and preparation – total contribution 65%

III. **Rejlová L.** Close, yet so distant: Diversification and island colonization in the genus *Urtica* (Urticaceae) in the Mediterranean biodiversity hotspot (unpublished review).

conceptualization, manuscript writing, and preparation – total contribution 100%

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ABSTRACT

Although European flora belongs among the best explored, there are still several marginally studied groups. One striking example is the polyploid complex of *Urtica dioica*, with multiple rare diploid taxa, which are often found in remote and partly relict geographic ranges, in contrast to cosmopolitan tetraploid individuals, which occur in a variety of synanthropic habitats and have an unknown evolutionary history. The thesis primarily deals with the evolution of diploid taxa recognized in Europe and contiguous areas of Southwest Asia (*Urtica dioica* subsp. *kurdistanica*, *U. d.* subsp. *pubescens*, *U. d.* subsp. *sondenii*, *U. d.* subsp. *subinermis*). This can lay the foundation for understanding phylogenetic relationships and revealing the evolutionary history of polyploids (*U. d.* subsp. *dioica*). The study also concerns itself with other related species outside of the complex *U. dioica*, especially from the Mediterranean area. An extensive dataset of 7012 samples from 1317 populations in a cytogeographical study has been analyzed, which covers most of the currently accepted diploid subspecies of *U. dioica*. From the entire dataset, a set of 279 plants (evenly representing the geographical and morphological variation) was used to estimate the extent of phylogenetic and morphological differentiation. The distinct dominance of tetraploids over diploids (87% of tetraploids and 13% of diploids) has been revealed, and for the first time, the rare triploid and pentaploid ploidy levels have also been detected, both in adults and in seeds. Subsequent analyses of absolute genome size showed uniform Cx-value among all studied diploid subspecies while differing significantly from Cx-values of other species related to *U. dioica* (*Urtica bianorii*, *U. cypria*, *U. kioviensis*, *U. rupestris*), which may be indicative of genetic distance. All revealed ploidy levels were verified by exact chromosome counts. A combination of molecular approaches was used to understand the basic phylogenetic relationships. The data evaluation took place first at the diploid level and then on the whole dataset; this approach was also used for morphometrics. Diploid subspecies form more or less separate clusters in morphological analyses, but molecular evaluation did not reveal any structure. Moreover, tetraploids merged with diploids in both morphological and molecular analyses. To reveal specific habitat requirements and ecological preferences of the cytotypes, the correlation with geographic parameters (latitude, longitude, and altitude), Bioclim modeling, and affinity to human-affected habitats has been applied. The diploid populations usually prefer lower altitudes, have a narrower ecological niche, and occur in less human-affected habitats in comparison to the ubiquitous, synanthropic tetraploid cytotype.

Keywords: bioclim modeling, cytogeography, ecological preferences, flow cytometry, Hyb-Seq, multivariate and geometric morphometrics, polyploidization, SNPs analysis, *Urtica dioica*

ABSTRAKT

Přestože evropská flóra patří mezi vůbec nejlépe probádané, můžeme v ní i tak nalézt řadu jen okrajově studovaných skupin. Jedním z takových příkladů je i polyploidní komplex kopřivy dvoudomé (*Urtica dioica*), ve kterém lze nalézt řadu vzácných diploidních taxonů, které se často vyskytují v nepřístupných a částečně reliktních oblastech, na rozdíl od kosmopolitně rozšířených tetraploidních jedinců, kteří vyhledávají především rozličná synantropní stanoviště a jejichž evoluční historie zatím nebyla zcela objasněna. Předkládaná disertační práce pojednává zejména o evoluci diploidních taxonů, rozeznávaných na území Evropy a v přilehlých oblastech jihozápadní Asie (*Urtica dioica* subsp.*kurdistanica*, *U. d.* subsp. *pubescens*, *U. d.* subsp. *sondenii*, *U. d.* subsp. *subinermis*). Poznání evoluce na diploidní úrovni může položit základ k pochopení fylogenetických vztahů a odhalit tak evoluční historii polyploidů (*U. d.* subsp. *dioica*). Studie se zabývá i dalšími příbuznými druhy vně komplexu *U. dioica*, a to zejména z oblasti Středomoří. V rámci cytogeografické studie byl zpracován rozsáhlý soubor 7012 vzorků z 1317 populací, zahrnující většinu v současnosti uznávaných diploidních poddruhů *U. dioica*. Z celého souboru vzorků bylo následně vybráno 279 rostlin (rovnoměrně pokrývajících geografickou i morfologickou rozmanitost), které byly využity pro zkoumání fylogenetické a morfometrické diferenciace. V rámci cytogeografických sběrů byla zjištěna výrazná převaha tetraploidních jedinců nad diploidními (87 % tetraploidů a 13 % diploidů). Vůbec poprvé se podařilo podchytit i vzácné triploidní a pentaploidní úrovně, které byly odhaleny jak v terénu, tak i v analýzách semen. Navazující analýzy velikosti genomu neukázaly výrazné rozdíly mezi diploidními poddruhy, avšak v rámci příbuzných druhů *U. dioica* byly Cx-hodnoty signifikantně rozdílné (*Urtica bianorii*, *U. cypria*, *U. kioviensis*, *U. rupestris*), což může být podpůrným znakem pro genetickou vzdálenost v molekulárních analýzách. Všechny podchycené ploidní úrovně byly ověřeny počítáním chromozomů. Pro pochopení základních fylogenetických vztahů byla použita kombinace různých molekulárních přístupů. Vyhodnocení dat probíhalo nejprve na diploidní úrovni a posléze na celém souboru vzorků, stejný postup byl použit i u morfometrických analýz. Diploidní taxony vytvořily více či méně oddělené shluky v rámci morfometrického zhodnocení variability, avšak v molekulárních analýzách nevytvořily rozeznatelnou strukturu. Navíc po přidání tetraploidních jedinců se obě skupiny sloučily v jeden neodlišitelný shluk, jak v molekulárních, tak i morfometrických analýzách. K podchycení specifických stanovištních vazeb a ekologických preferencí jednotlivých cytotypů byla využita korelace se zeměpisnou šířkou, délkou a nadmořskou výškou, bioklimatické modelování a míra afinity k člověkem ovlivněným stanovištím. Diploidní populace nejčastěji dávají přednost nižším nadmořským výškám, mají užší ekologickou niku a vyskytují se v člověkem méně ovlivněných prostředích ve srovnání s všudypřítomným, synantropním tetraploidním cytotypem.

Klíčová slova: bioklimatické modelování, cytogeografie, ekologické preference, Hyb-Seq, multivariační a geometrická morfometrika, polyploidizace, průtoková cytometrie, SNPs analýza, *Urtica dioica*

CONTENT

LIST OF ARTICLES

This thesis is based on the following publications:

I. **Rejlová L.**, Chrtek J., Trávníček P., Lučanová M., Vít P., Urfus T. (2019): Polyploid evolution: The ultimate way to grasp the nettle. Plos One 14: e0218389.

II. **Rejlová L.**, Böhmová A., Chumová Z., Hořčicová Š., Josefiová J., Schmidt P.-A., Trávníček P., Urfus T., Vít P., Chrtek J. (2021): Disparity between morphology and genetics in *Urtica dioica* (Urticaceae). Botanical Journal of the Linnean Society 195: 606–621.

III. **Rejlová L.** Close, yet so distant: Diversification and island colonization in the genus *Urtica* (Urticaceae) in the Mediterranean biodiversity hotspot (unpublished review).

The case studies are referred to by the corresponding Roman numerals in the following text (i.e., CS I, II, III).

PART A – GENERAL CHAPTERS

INTRODUCTION

Although plant invasion in Europe is well explored, a number of unresolved issues remain regarding some well-known plant groups that had been neglected until recently. One of the demanding topics is the evolutionary origin of weeds with two main areas of interest (Pyšek & Richardson, 2006; Pyšek *et al.*, 2008; Richardson & Pyšek, 2008). Firstly, the success of only certain species which become fast and, in most cases, effective colonizers. Secondly, what is their impact on native species and communities (Vilà *et al.*, 2010, 2011; Pyšek *et al.*, 2012). Predicting all characteristics and traits associated with successful and wide spreading that could be applied to all vascular plants is infeasible. However, by examining different species in a variety of environments, a number of common traits have been identified that can be observed to be generally accepted, e.g., wide environmental tolerance, self-compatibility, large seed set, effective seed dispersal, a combination of various reproduction strategies, briefness of juvenile period, phenotypic plasticity, increased relative growth rate, and high competitive ability (Daehler, 1998; Levin, 2000; Hayes & Barry, 2008). The range of the mentioned traits is also associated with the effect of polyploidy (often preceded by hybridization), which is accepted as an important evolutionary driver that can alter not only the ecology and physiology but also the genetic make-up and the morphology of the plants (Pandit *et al.*, 2011, te Beest *et al.*, 2012; see also Glennon *et al.*, 2014).

One of the unique but neglected species is *Urtica dioica* L., which is well-suited as a model expansive species with a synanthropic distribution (prefers habitats created or influenced by man), which is related to its successful adaptation to various nutrient-rich sites. Various life-history traits such as the formation of an abundant and persistent seed bank, intensive vegetative spread by underground stolons (horizontal stems used for vegetative propagation), the ability to regenerate from separated parts of stolons, and polyploidy, could significantly contribute to its weediness, widespread distribution and the formation of dense and monospecific vegetation (Ivins, 1952; Thompson & Grime, 1979; Wheeler, 1981; Roberts & Boddrell, 1984; Hara & Šrůtek, 1995; Šrůtek & Teckelmann, 1998; Taylor, 2009; Rejlová *et al.*, 2019). The tenacity of *U. dioica* is, besides others, a threat to native island communities, including associations with endemic species of *Urtica* L., which are particularly threatened by its better competitiveness. For example, *U. dioica* has become a common weed after it was introduced to New Zealand, endangering local endemics (Webb *et al.*, 1988; Grosse-Veldmann *et al.*, 2016a). On the other hand, the introduced representatives of the species partially complement the role of food plants for the rare and endangered butterflies (*Vanessa gonerilla* Fabricius, along with their described subspecies, and *Vanessa itea* Fabricius; Fig. 1) and thus help increase their populations (Chudleigh, 1999; Barron *et al.*, 2004; Barron, 2007). In general, the vegetation of *U. dioica* is colonized by a large number of phytophagous insect species (e.g., *U. dioica* is the food plant for *Aglais urticae* L.; Fig. 2) with a positive impact on their abundance and diversity (Pullin, 1987; Davis, 1989, 1991; Beneš *et al.*, 2002; James *et al.*, 2015).

Urtica dioica is a diploid-polyploid species with still unclear taxonomic delimitation and intraspecific classification. There are two major ploidy levels: tetraploids are widespread and with an unknown evolutionary history, while the less common diploids occur in restricted and partly relict geographic ranges. Within the species, a number of vaguely delineated subspecies and varieties have been described based on minor morphological variations, such as the high density of stinging/unicellular trichomes, or the presence of monoecious forms of plants in commonly dioecious populations. For example, Domin (1944) distinguishes 12 subspecies of *U. dioica*, some of them further subdivided, consisting of 29 varieties/morphotypes in total. At present, similar approaches to classification are being abandoned due to high phenotypic plasticity and possible environmental influence. An example is the tetraploid cytotype of *U. dioica* extending into synanthropic habitats, with stronger grazing selective pressure, which affected the density of stinging trichomes and also the formation of abnormal monoecious individuals (Thurston & Lersten, 1969; Pollard & Briggs, 1984a; Weigend, 2005, 2006; Grosse-Veldmann & Weigend, 2015, 2018). The issue is further complicated by the unresolved phylogenetic relationships. Moreover, the ploidy levels were not directly considered in the latest phylogenies (Farag *et al.*, 2013; Henning *et al.*, 2014; Grosse-Veldmann *et al.*, 2016b).

In addition, man has been using this ‘herb’ or ‘crop’ plant for centuries, which may have led to its wider distribution (Di Virgilio *et al.*, 2015). Some of the earliest evidence of the use of nettle fibers comes from the late Neolithic Age. Nettle fibers were found with the iceman Ötzi, who probably used them as a bowstring or to fasten the fletching and arrowheads (Junkmanns *et al.*, 2019). It is also worth mentioning that the oldest surviving written reference of the use as ‘crop’ plant dates back to 60 A.D – Lucius Junius Moderatus Columella in “*De re rustica libri* XII.” (Domin, 1944). However, the widely useful plant (currently used e.g., in applied research – treatment of diabetes and prostate diseases, textile industry, cosmetics; Bredemann & Garber, 1959; Farzami *et al.*, 2003; Bacci *et al.*, 2009; Mohammadi *et al.*, 2016) has become an anthropochorous, troublesome weed species (especially in Central Europe).

1. GENERAL INTRODUCTION TO THE NETTLE FAMILY

1.1. The family Urticaceae Juss.

Although several studies and approaches attempted to solve the systematics among the major clades of Rosales Bercht. & J. Presl, some branches and nodes are problematic, and their relationships remain unresolved. Nevertheless, the classification of Urticaceae to the order Rosales is stable and not influenced by the latest phylogenies (Sytsma *et al.*, 2002; Ravi *et al.*, 2007; Zhang *et al.*, 2011; Wu *et al.*, 2013). The family consists of 52–58 genera and 2000–2700 species of various growth forms including herbs, shrubs, small trees, and rare types of lianas (woody climbers; Friis, 1993, Wu *et al.*, 2013; Kim *et al.*, 2015; Christenhusz & Byng, 2016; Stevens, 2017; POWO, 2022). The representatives are widely distributed on almost all continents (except for the polar region of Antarctica; Fig. 3), with the center of occurrence in tropical and subtropical regions, and the highest diversity in tropical Asia (Friis, 1993; Takhtajan, 2009; Stevens, 2017). The Urticaceae had initially been described and categorized based on inflorescent morphology; later, the determination was supplemented by gender distribution and the morphology of ovules with embryos. The first circumscription of the family Urticaceae (Jussieu, 1789), later revised by Gaudichaud (1830), treated together members of recently accepted families Urticaceae, Cecropiaceae C. C. Berg, Moraceae Gaudich., and Cannabinaceae Martinov, and divided Urticaceae into five tribes, namely Urereae, Elatostemeae, Boehmerieae, Parietarieae, and Forskalieae. Weddell (1854, 1856, 1869) later separated Moraceae and Cannabaceae from Urticaceae and divided the remaining Urticaceae into similar tribes as Gaudichaud. This grouping was maintained with small variations until the first use of combined molecular approaches (Friis, 1993; Kravtsova, 2009; Wu *et al.*, 2013; Kim *et al.*, 2015). The previously recognized family of Cecropiaceae turned out to be problematic due to having an intermediate morphology between Moraceae and Urticaceae (Singh, 2010). Based on later molecular analyzes, the Cecropiaceae family was entirely merged into Urticaceae, forming its own tribe Cecropieae Dumort. (The Angiosperm Phylogeny Group, 2003; Hadiah *et al.*, 2008; Wu *et al.*, 2013; Kim *et al.*, 2015). The last phylogenies of the family Urticaceae used a combination of nuclear and plastid DNA sequence data, establishing six monophyletic tribes Boehmerieae Gaudich., Elatostemateae Gaudich., Forsskaoleeae Gaudich., Parietarieae Gaudich., Urticeae Lam. & DC., Cecropieae (Wu *et al.*, 2013; Kim *et al.*, 2015), and three evolutionary lineages, i.e., (i) Boehmerieae Cecropieae-Forsskaoleeae-Parietarieae, (ii) Elatostemateae, and (iii) Urticeae (including *Poikilospermum* Zipp. ex Miq.; Hadiah *et al.*, 2008). Within the tribe Urticeae five clades are currently recognized: A) *Urtica* + *Hesperocnide*, Zhengyia T. Deng, D. G. Zhang & H. Sun, *Laportea* I, *Nanocnide* Blume, B) *Dendrocnide*, *Discocnide* Chew, C) *Girardinia* Gaudich., D) *Laportea* II, and E) *Obetia* Gaudich., *Urera*, *Poikilospermum* (Deng *et al.*, 2013; Wu *et al.*, 2013; Kim *et al.*, 2015).

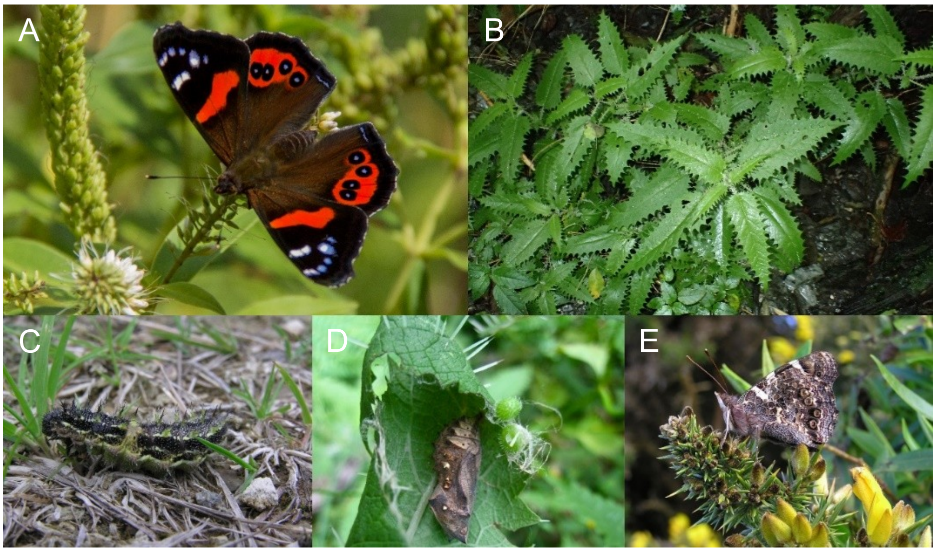

Figure 1. *Vanessa gonerilla gonerilla* Fabricius – New Zealand red admiral **(A)** mature individual (photo by Kimberley Collins; file is licensed under the CC BY-SA 4.0); **(B)** preferred foodplant *Urtica ferox* G. Forst. (photo by Krzysztof Ziarnek, 2017; file is licensed under the CC BY-SA 4.0); **(C)** caterpillar (photo by Tony Wills; file is licensed under the CC BY-SA 3.0); **(D)** pupa (photo by Roger Frost; file is licensed under the CC BY-NC); **(E)** underside wing (photo by Tony Wills; file is licensed under the CC BY-SA 3.0). Data (A, C-D) available at: Manaaki Whenua Landcare Research 2022.

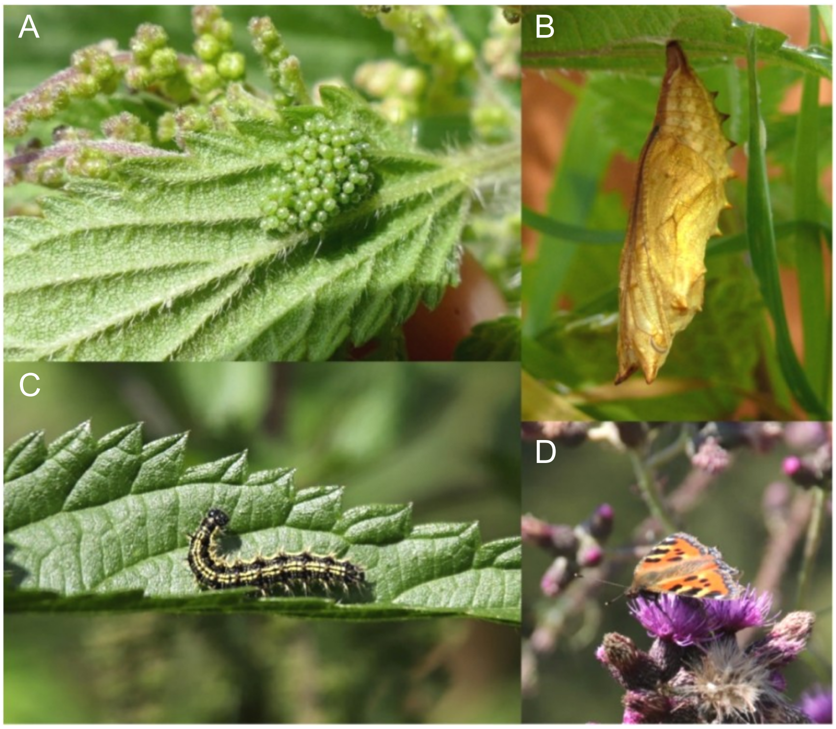

Figure 2. *Aglais urticae* L. – small tortoiseshell **(A)** eggs (photo by Jurgen Couckuyt 2017; file is licensed under the CC BY-NC-ND); **(B)** pupa (photo by Harald Süpfle 2008; file is licensed under the CC BY-SA 2.5); **(C)** caterpillar ("Modrava", National Park "Šumava", Czech Republic; photo by Ludmila Rejlová); **(D)** mature individual ("Kvildský les", National Park "Šumava", Czech Republic; photo by Ludmila Rejlová).

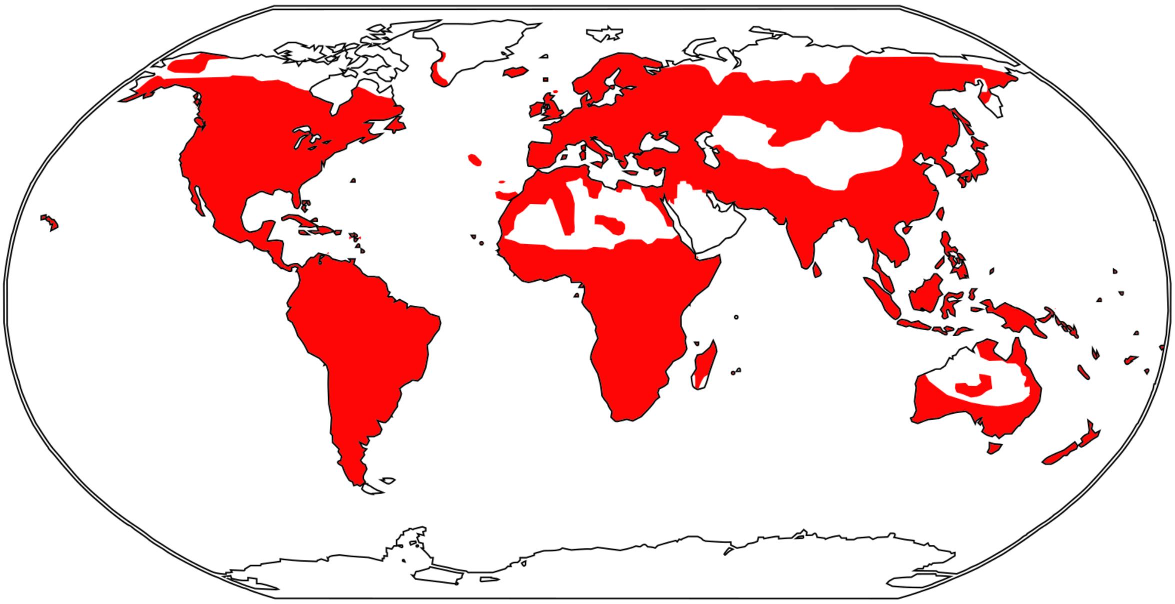

Figure 3. Map of the distribution of the family Urticaceae (the distribution data adopted from Stevens, 2017).

2. BIOSYSTEMATIC INSIGHT INTO NETTLES

2.1. The genus *Urtica* L.

Urtica is the largest genus within the tribe Urticeae with (30–)60–80 recently recognized species (Wu *et al.*, 2013; Kim *et al.*, 2015; Grosse-Veldmann *et al.*, 2016b; POWO, 2022).

Representatives of the genus are mostly annual or perennial herbs with centers of occurrence in the temperate zone of both hemispheres and the overall occurrence being cosmopolitan (except Antarctica and extreme polar and tropical regions; POWO, 2022). Most of the species are well-known and common in various nutrient-rich anthropogenic habitats (Ivins, 1952; Šrůtek & Teckelmann, 1998). However, many species can be found in relict and natural habitats. The genus includes a relatively large number of island endemics, which almost half of them can be found in the Mediterranean Basin (i.e., *Urtica atrovirens* Req. ex Loisel. – Corsica and Sardinia, *U. bianorii* (Knoche) Paiva – Balearic Islands, *U. cypria* (H. Lindb.) Hand – Cyprus, *U. morifolia* Poir. – Canary Islands, *U. portosanctana* Press – Madeira, *U. rupestris* Guss. – Sicily, *U. stachyoides* Webb & Berthel. – Canary Islands; Fig. 4; Webb, 1849; Meikle, 1985; Paiva, 1993; Weigend, 2006; Borges *et al.*, 2008; Dobignard & Chatelain, 2013; Pignatti *et al.*, 2019). In addition, other non-European island endemics can be found in America (*Urtica domingensis* Urb. – Caribbean island Hispaniola, *U. glomeruliflora* Steud. – Pacific Juan Fernández Islands; Grosse-Veldmann , 2016; POWO, 2022), New Zealand (*Urtica ferox* G. Forst., *U. perconfusa* Grosse-Veldm. & Weigend; Grosse-Veldmann *et al.*, 2016a; POWO, 2022) and in Asia and Oceania (e.g., *Urtica grandidentata* Miq. – Indonesia, *U. taiwaniana* S. S. Ying – Taiwan; *U. papuana* Zandee – Papua New Guinea; Zandee, 1969; Chen *et al.*, 2003; Becker *et al.*, 2017).

The rate of island colonization in the genus *Urtica* is significant within angiosperms and deserves further research. On the other hand, many rare species co-occur with related species that are widespread and successful in synanthropic habitats. An example is the common *Urtica magellanica* Juss. ex Poir. and *U. leptophylla* Kunth co-exist with relict forest endemics *U. lalibertadensis* Weigend, *U. peruviana* Geltman, *U. urentivelutina* Weigend in the Andean mountains, with elevations exceeding 4000 m a.s.l. (Geltman, 1998; Weigend *et al.*, 2005; Mutke *et al.*, 2014). Another example is the co-occurrence of the synanthropic and widespread *Urtica dioica* subsp. *dioica* with rare diploid subspecies *U. d.* subsp. *pubescens* (Ledeb.) Domin, subsp. *sondenii* (Simmons) Hylander and subsp. *subinermis* (R. Uechtr.) Weigend in Europe (Weigend, 2005; Grosse-Veldmann & Weigend, 2015; Rejlová *et al.*, 2019).

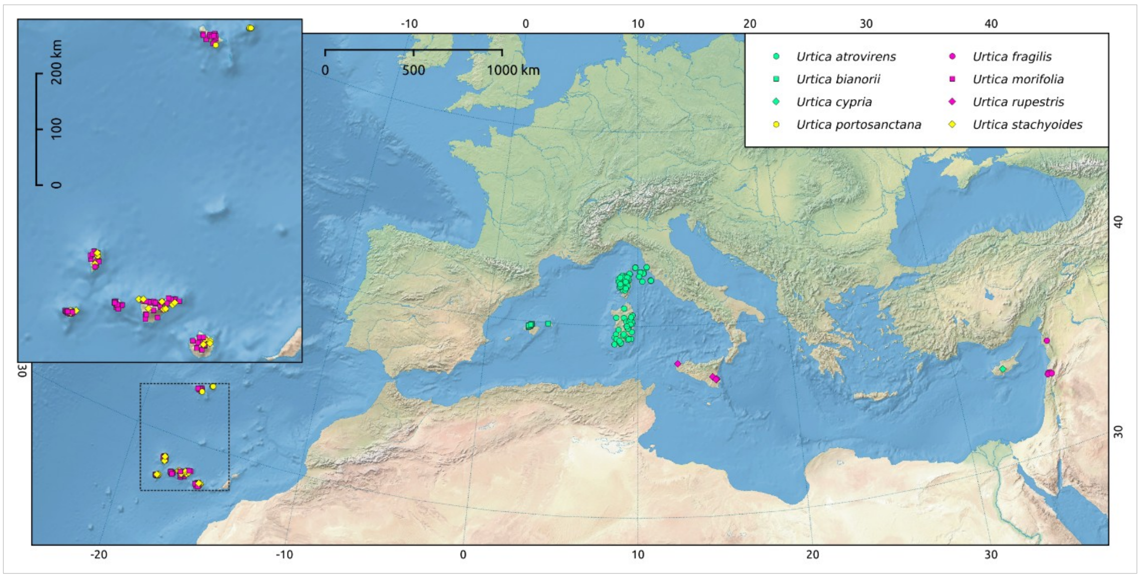

Figure 4. Spatial distribution of endemic species of the genus *Urtica* L. in Mediterranean hotspot along with their phylogenetic linkage. Distinguished are the bright green group (*Urtica atrovirens* Req. ex Loisel., *U. bianorii* (Knoche) Paiva, *U. cypria* (H. Lindb.) Hand), magenta group (*Urtica fragilis* J. Thiébaut, *U. morifolia* Poir., *U. rupestris* Guss.), yellow group (*Urtica portosanctana* Press, *U. stachyoides* Webb & Berthel.). Map section in the top left corner – detail of the Canary Islands and Madeira. More details in **CS III**. Data source: National Center for Biotechnology Information database; Natural Earth – Free vector and raster map data; Grosse-Veldmann *et al.*, 2016b; Rejlová *et al.* 2021, WCSP, 2022.

2.2. Evolutionary mechanisms in the genus *Urtica*

New forms and species can originate through a number of mechanisms, including geographic isolation, polyploidy and hybridization. The gradual processes of speciation that take place within geographically more or less isolated subpopulations include mutations, random influences (founder effect, genetic drift and bottleneck effect), selection and migration (Rieseberg & Willis, 2007; Smadja & Butlin, 2011). Based on the means of geographical separation we distinguish two basic ways of speciation (Coyne & Orr, 2004), namely: allopatric speciation (the original area is divided by a geographical barrier that does not allow gene flow; this results in separate development and origin of two different populations; reproductive isolation mechanisms evolve gradually; populations re-merge into one species if the barrier is removed shortly) and sympatric speciation (no physical barrier; a new species begins to originate from one population in the same area, e.g., the recent origin of three nominal forms of the Tennessee cave salamander from epigeic spring salamanders by divergence with gene flow; Niemiller *et al*., 2008).

Furthermore, we can encounter two transitional states: peripatric speciation (the original area of the species oscillates; small isolated populations remain after repeated reduction of the area; multiple new species form in a small area, creating a so-called 'species swarm'; random phenomena have a large influence on allele frequency and genetic variability) and parapatric speciation (subpopulation areas overlap only in a very narrow contact zone, e.g., due to uneven distribution or incomplete physical barrier; there is non-random mating and uneven genetic flow, which increases dimorphism between populations; Coyne & Orr, 2004). Finally, it is also necessary to mention the influence of man, one of the main drivers of ecological, geographical and landscape changes in the environment, which is a significant factor in the mentioned processes of speciation and biodiversity (Cardinale *et al.*, 2012; Bull & Maron, 2016).

Hybridization (the formation of offspring by crossing of two genetically distinct parental taxa) is quite common in nature (approximately 25% of plant and 10% of animal species hybridize; Mallet, 2005). The evolutionary significance of hybridization has been questioned in the past (Rieseberg, 1997; Rieseberg & Carney, 1998; Mallet, 2007), especially due to collision with the biological concept of species (Mayr, 1942; Coyne & Orr, 2004) and the assumption that hybridization produces mostly less viable and fertile individuals that are unable to reproduce further or only to a limited extent (Mayr, 1963; Seehausen, 2004; Mallet, 2005). For a better understanding of the evolutionary importance of hybridization (Anderson & Stebbins, 1954; Arnold, 1997; Rieseberg, 1997) a thorough examination of reproductive isolation mechanisms has made a significant contribution (i.e., prezygotic and postzygotic; Stebbins, 1950; Grant, 1981; Levin, 2000; Rieseberg & Willis, 2007). Also, the biological concept of a species (currently the most used definition of the species) emphasizes reproductive isolation as a key step in speciation in all of its versions (Mayr, 1942, 1969, 1982; Coyne & Orr, 2004; Hermansen *et al.*, 2011).

In *Urtica* allopatric speciation was probably behind the above-mentioned significant island diversification. Interspecific hybridization has been reported between *U. dioica* and *U. kioviensis* (Buchwald *et al.*, 2013; Rejlová & Urfus, 2018; Karlsson & Agestam, 2019), U. *dioica* and. *U. urens* (*Urtica* ×*oblongata* Koch ex Maly; Stace, 1975; Goliašová, 2016; POWO, 2022) and *U. membranacea* and *U. urens* (*Urtica* ×*tremolsii* Sennen; Paiva, 1993; GBIF, 2022).

Polyploidy is the state of a cell or organism in which more than two sets of chromosomes are present (from a molecular point of view, traces of genome duplication, i.e., paralogous genes). It is less common in the animal kingdom due to chromosomal sex determination, nucleotypic effect, and lethality in most cases. However, there are exceptions such as Platyhelminthes, freshwater fish Salmonids, amphibian mole salamander, etc.; Lowcock, 1994; Beukeboom *et al.*, 1998; de Boer *et al.*, 2007). Polyploidy is widespread among ferns and flowering plants, and it is widely considered one of the most important evolutionary forces driving the diversification of angiosperms (Soltis *et al.*, 2009; Weiss-Schneeweiss *et al.*, 2013). The frequency of polyploids has been estimated in the past on the basis of chromosome counts and varied considerably among sources from 20% to up to 80% (Stebbins, 1938; Grant, 1963; Lewis, 1980). Recent studies based on sequencing plant genomes suggest that all angiosperms have undergone one or more polyploidization events in their evolutionary history (Jiao *et al.*, 2011; Wendel *et al.*, 2016). Currently, the estimated proportion of recent polyploids (neopolyploids) among angiosperms is 33–35% (Wood *et al.*, 2009; Rice *et al.*, 2019). Within other groups, most polyploids can be found among sporophyte plants (90–95%). On the other hand, polyploidy is very rare in gymnosperms, even absent in certain groups.

We distinguish two main mechanisms of chromosome set multiplication that results in the origin of polyploid individuals. Autopolyploids are produced by multiplying its own chromosome set within the same population, usually by fusion of unreduced gametes (Otto & Whitton, 2000; Kreiner *et al.*, 2017a, b). A less frequent means of origin is when chromosomes fail to separate during mitosis, which can also be caused by external factors such as exposure to heat or chemicals (e.g., colchicine; Dhooghe *et al.*, 2011). Newly formed autopolyploid individuals have a lower probability of survival (and thus participation in further speciation) for the reason of similarity with the parents and reduced fertility caused by meiotic problems. Compared to that, allopolyploids are produced by hybridization between different populations, forming a hybrid that may produce fertile polyploid offspring by forming a wide range of unreduced gametes, although few in number (Ramsey & Schemske, 1998). The newly created polyploid offspring have genetic compositions different from either parent, which allows them to establish successfully and colonize new ecological niches. Furthermore, homologs often form a successful bivalent pairing during meiosis, which leads to fertile offspring. In most cases, the allopolyploid taxa have different ecological tolerances from their diploid progenitors (Ramsey, 2011). The frequency of unreduced gamete formation in nature is different for various populations and also for non-hybrid taxa (0.56%) compared to hybrid taxa (27.5%; Ramsey & Schemske, 1998). Their production may also be influenced by stress conditions (e.g., temperature fluctuations, nutrient deficiency; Levin, 2003). In the past, a number of studies have explored the predominance of individual types of polyploids, with mutually conflicting results (Clausen *et al.*, 1945; Soltis *et al.*, 2007). A recent analysis has shown that both types are approximately equally common (Barker *et al.*, 2016). The inconsistency in the results is mainly caused by allopolyploids being much more frequently described as independent species due to their apparent phenotypic difference from their parents, while autopolyploids contribute to the cryptic diversity of plants (Soltis *et al.*, 2007; Barker *et al.*, 2016). Frequently, a variety of transient types can be found (such as 'segmental allopolyploids' consist of mixture auto- and allopolyploid segments derived through homoeologous exchanges e.g., *Oryza sativa* L. and *Arachis hypogaea* L; Stebbins, 1947; Sun *et al.*, 2017;

Leal-Bertioli *et al.*, 2018; Bertioli *et al.*, 2019; Mason & Wendel, 2020). Newly emerging polyploid individuals (neopolyploids) are established in the environment by overcoming barriers such as minority cytotype exclusion, frequency-dependent mating disadvantage, and triploid block, resulting in stabilization of the new polyploid lines (Ramsey & Schemske, 2002).

Different ploidy levels may cause the formation of different lineages or even species, increasing intraspecific variability (Thompson & Lumaret, 1992; Ohri, 1998). Various cytotypes often occur sympatrically, and according to recent knowledge, up to sixteen percent of vascular plants consist of several cytotypes (Rice *et al.*, 2015). Another aspect of polyploidization is the immediate influence on a number of physiological (e.g., cell size, stomas size, duration of mitosis) and ecological (e.g., invasiveness, synanthropic affinity, broader ecological plasticity) processes (Levin, 2002; Francis *et al.*, 2008). The prediction of the occurrence of polyploids shows a noticeable latitudinal gradient as the frequency of polyploids increases from the equator to the poles. Polyploids are more common in areas of earlier glaciation, often with stress conditions, while subtropics and tropics are the poorest for polyploids (Rice *et al.*, 2019). The whole range of these effects consequently leads to better adaptability (Maherali *et al.*, 2009; Ramsey, 2011) and resistance of polyploid lineages, thus allowing their wider spread over their diploid relatives (e.g., *Arabidopsis arenosa* (L.) Lawalrée, *Cardamine amara* L., *Centaurea stoebe* L.; Lumaret *et al.*, 1987; Treier *et al.*, 2009).

Within the genus *Urtica*, various species with different chromosome numbers can be found (Rice *et al.*, 2015); however, there is no clear evidence that this leads to significant diversification. The most studied in the genus *Urtica* is the di-, tetraploid complex of *U. dioica*. The possible allopolyploid origin of tetraploids (by hybridization of diploid subspecies *U. d.* subsp. *subinermis* and subsp. *sondenii*, and *U. d.* subsp. *subinermis* and subsp. *pubescens*) is mentioned by Geltman (1986, 1992). Also, Glawe & de Jong (2007) consider the species *U. dioica* to be allotetraploid based on mapping of polymorphic markers (Glawe, 2006) and partially supported by allozyme data from four loci indicating disomic inheritance (Mutikainen & Koskela, 2002). However, due to the low number of examined populations and the absence of sufficient screening throughout their geographical distribution area, current knowledge could not provide significant evidence on either origin of tetraploid individuals or relevant influence of polyploidy on diversification of this species.

2.3. Gender distribution and sex ratio in the genus *Urtica*

A number of sexual systems can be found within angiosperms, varying for different flowers, inflorescences, individuals within populations, and entire populations. The most frequent sexual system in flowering plants is hermaphroditism, followed by monoecy (individual has both male and female flowers), dioecy (distinct male and female plants in population), and polygamy (populations with bisexual/hermaphroditic individuals, male individuals, and female individuals; Renner, 2014). There are also many variants of the aforementioned systems, as well as some transient states (e.g., androdioecy, andromonoecy, gynodioecy, gynomonoecy, etc.; Sakai & Weller, 1999; Pannell, 2002; Bailey & Delph, 2007; Renner, 2014).

Dioecy is one of the phenomena that is shaping not only the genus *Urtica* but the entire family as well (Wu *et al.*, 2018). Of all the genera in Urticaceae, 52% are dioecious (Renner & Ricklefs, 1995), while many of them also contain both mono- and dioecious forms (with a range of transition states). Specifically, in the genus *Urtica*, recent studies pointed to distinct diversification of gender patterns with a transient architecture (Grosse-Veldmann & Weigend, 2018). Genera with both forms offer an opportunity to examine the origin and development of these sexual systems. For comparison, within flowering plants, the proportion of dioecious genera is estimated at only 7% (ca 987 genera; Renner, 2014, earlier estimation 4%; Dellaporta & Calderon-Urrea, 1993), with dioecy occurring mainly in the tropical zone, less so in the temperate zone (Charlesworth, 1985; Dellaporta & Calderon-Urrea, 1993; Renner, 2014). Dioecy may be advantageous in environments with changing conditions (Costich, 1995), is typically found on island habitats, and favors certain growth forms, i.e., tropical woody plants, trees, and shrubs show a much higher incidence of dioecy than herbs (Bawa, 1980). The evolution of dioecy has not yet been satisfactorily explained (Spigler & Ashman, 2012; Charlesworth, 2013; Dufay *et al.*, 2014); it is often associated with the presence or absence of cytoplasmic male sterility genes and nuclear restorer genes (Kheyr-Pour, 1980; van Damme, 1983; Bailey & Delph, 2007). Dioecy probably emerged repeatedly throughout history, with polyploidization possibly being related to its origin (Volz & Renner, 2008; Ashman *et al.*, 2013). Another context related to the evolution of dioecy is wind pollination. A relatively large proportion of dioecious species (up to 30% of dioecious genera; Renner & Ricklefs, 1995) are abiotically pollinated (i.e., wind or water pollination). Wind pollination is considered a derived condition from insect pollination, due to phylogenetic analyses suggesting an insect-pollinated ancestor for many abiotically pollinated species (Blattner & Kadereit, 1999; Li *et al.*, 1999; Thien *et al.*, 2000). The shift in pollination strategy in connection with dioecy is mainly related to the cost of effective biotic pollination (Bawa, 1980; Obeso, 2002; Mitchell *et al.*, 2009), adaptation to changing conditions (Costich, 1995; Renner & Ricklefs, 1995; Friedman & Barrett, 2009), and promoting outcrossing (Bawa, 1980; Thomson & Barrett, 1981). The genus *Urtica* is specific for having almost universally unisexual flowers (Friis, 1993), which is quite rare within angiosperms, with only about 10% of all representatives being unisexual (Barrett, 2002). This floral structure promotes obligate outcrossing and prevents selfing. The species are wind-pollinated with explosive anthers (Fig. 5) that literally throw pollen grains into the environment (Montoya-Pfeiffer *et al.*, 2016), which may be associated with the dispersion of pollen grains over long distances, thus it could facilitate gene flow between remote populations (Ranta *et al.*, 2008).

Another attribute related to dioecy is the proportion of male and female individuals in populations. For most sexually dimorphic species, the sex ratio is assumed to be 1:1 (mainly due to the control of nuclear genes). The uniform ratio has been shown in many dioecious species, such as *Rumex acetosa* L. (Putwain & Harper, 1972; Błocka-Wandas *et al.*, 2007), while the contrary has been proven for some others (e.g., *Silene latifolia* Poir.; Carroll & Mulcahy, 1993; Hathaway *et al.*, 2009). As for the genus *Urtica*, detailed studies concentrate on *U. dioica*, as it is the most well-known and widespread species of the genus. Significant differences in primary sex ratios of *U. dioica* have been found (de Jong *et al.*, 2005; Glawe & de Jong, 2005, 2007). An experimental crossing of male and female plants (individuals from a population with different sex ratio) was performed to explore the inheritance process of sex ratio. The results indicate that the sex ratio of the offspring roughly reflects the sex ratio of the original maternal population. Maternal gender distortion can be related to intragenomic conflict, selfish genes, or cytoplasmic factors (de Jong *et al.*, 2005; Glawe & de Jong, 2007, 2009; Shannon & Holsinger, 2007). The sex determination might also be related to the presence of sex chromosomes, which are found in a number of other dioecious species (i.e., *Humulus lupulus* L., *Mercurialis annua* L., *Silene latifolia*, and *Rumex acetosa*; Shibata *et al.*, 1999; Ming *et al.*, 2011; Russell & Pannell, 2015). Previous literature (Strasburger, 1910; Meurman, 1925) refers to differentiated sex chromosomes in *U. dioica*, but recent studies did not observe morphological differences within the chromosome pairs (Glawe & de Jong, 2009).

Within a population of the commonly dioecious *U. dioica*, monoecious forms can sometimes be found (Fig. 6). These abnormal individuals were repeatedly described as separate varieties (e.g., *Urtica dioica* var. *hermaphrodita* Čelak., *U. d.* var. *mirabilis* Zapał., *U. d.* var. *monoica* Tausch ex Ott). This was despite the fact that they did not differ in any other feature from the rest of the individuals in the population, did not occur independently, and did not form dominant populations (de Jong *et al.*, 2005; Glawe & de Jong, 2005, 2007). For dioecious angiosperm species, genetic mechanisms for sex determination are mostly unexplored. Therefore, each species that has both a dioecious and a monoecious form provides an opportunity to explore these mechanisms, and to help gain a better insight into the evolution of dioecy. During the experimental crossing of monoecious individuals of *U. dioica* and *U. gracilis* Aiton (North American clade of nettle, which is exclusively monoecious; Woodland, 1982; Woodland *et al.*, 1982; Henning *et al.*, 2014; Grosse-Veldmann *et al.*, 2016b), it was found that the genetic basis of monoecy is probably different in both species due to diametrical differences in sex ratios in the offspring. This result was unexpected, given the assumption that monoecy is taken as the original state in a species where both monoecious and dioecious forms occur. The inconsistency can be related to the ploidy level of *U. gracilis*, whose common diploid form is not able to cross with some tetraploid individuals (including *U. d.* subsp. *dioica*; Woodland, 1982; Woodland *et al.*, 1982; Boufford, 1997; Shannon & Holsinger, 2007). Hybridization across different species with a different sexual system in natural conditions is also possible, as evidenced by the presence of hybrids of *U. dioica* (dioecious, tetraploid individual) and *U. kioviensis* Rogow. (monoecious, diploid individual) in Nature Reserve "Plačkův les a říčka Šatava" in southern Moravia (Rejlová & Urfus, 2018).

When examining the genetic basis of sex determination in monoecious and dioecious individuals of *U. dioica*, a different genetic basis was found during crossbreeding.

Results indicated that the monoecious trait (crossings among offspring obtained after selfing monoecious plants) is easily transferred to the offspring (up to 80%), is governed by Mendelian processes of inheritance, and can be transmitted by both seeds and pollen. Further crossings between plants from the monoecious and dioecious systems indicated that alleles from the dioecious system are often dominant. However, other crossings have not confirmed this result, which may mean that the dominance is incomplete or that multiple genes are involved in sex determination (Glawe & de Jong, 2009).

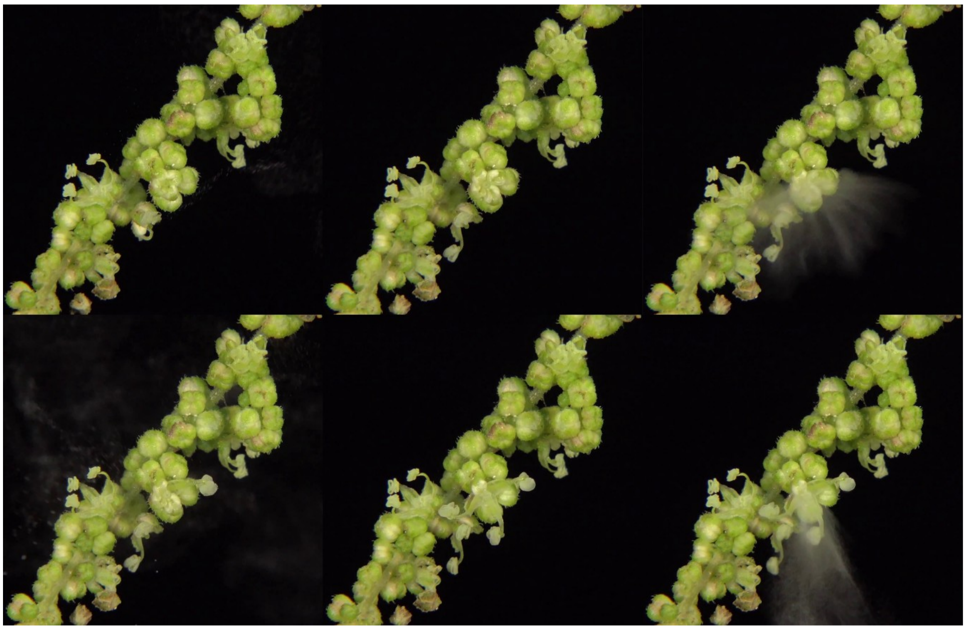

Figure 5. Staminate flowers of *Urtica dioica* L. with explosive anthers (video by Rüdiger Hartmann©, 2015, video frames n. 780, 802, 804, 824, 854, 859; file is licensed under the copyright law – free of charge for private and non-commercial educational purposes).

Figure 6. Monoecious individuals of *Urtica dioica* L. with detail of male and female flower from own herbarium collection (population UP0052/individual U0164; Supporting Table 1 in **CS I**; the overall number of captured monoecious individuals were on the order of per mille; photo by Ludmila Rejlová).

2.4. Seeds dispersal as the main mean of gene flow

For angiosperms, the means of seed dispersal plays a crucial role not only in gene flow, but also in colonization, and affects changes in gene frequencies within populations and geographic plant distributions on a broader scale. Most of the dispersal is at a local scale, but long-distance dispersal is the factor that enables colonization of unoccupied habitats and thus increases the fitness of the population (Webb, 1998). The basic vectors for long-distance dispersal are mainly hydrochory (water dispersal), anemochory (wind dispersal), and animal dispersal (zoochory; Cain *et al.*, 2000).

Seeds in the family of Urticaceae have the form of achenes (monocarpellary and indehiscent). Within the tribe Urticeae the achenes (examples of the morphology and surface structure of the achenes in Fig. 7) are dispersed in various forms, e.g., without a perianth (*Urtica*, *Laportea*), with an enclosed and dry perianth (*Urtica*, *Laportea,* and *Hesperocnide*), an accrescent dry perianth forming wings (*Obetia*), and an accrescent fleshy perianth (*Urera*; Friis, 1993; Simpson, 2010) with no obvious adaptation for long-distance dispersal (Wu *et al.*, 2018).

Representatives of the genus *Urtica* use various dispersal mechanisms with a predominance of animal and water dispersal. That enables them to colonize the mainland successfully, and also facilitates the dispersion between continents and various islands, as evidenced by the number of island endemics (Grosse-Veldmann *et al.*, 2016a, b). Despite the developed mechanism of stinging trichomes with toxic substances, the presence of seeds of the genus *Urtica* in the excrements were confirmed to be relatively common. Seeds have most frequently been found in feces of birds and droppings of herbivorous animals, often having passed through the digestive tract intact, which can help wide dispersal and also better germination (Couvreur *et al.*, 2005; Holland *et al.*, 2006; Eycott *et al.*, 2007; Kuiters & Huiskes, 2010). In some cases, special adaptations are also employed to ease transfer, e.g., achenes covered with a dense cover of large trichomes that stick to animals (*Urtica trichantha* (Wedd.) Acevedo& L. E. Navas; Navas, 1961), or production of sweet mucilage in order to adhere to the feathering of birds or encourage consumption of seeds by birds (*Urtica stachyoides*, *U. morifolia*). According to a recent phylogenetic study (Grosse-Veldmann *et al.*, 2016b), most island endemics are result of at least two independent colonizations (with the exception of Hawaii and the Juan Fernández Islands).

A secondary strategy for successful colonization of the mainland (typical for the genus *Urtica*) is the vegetative reproduction by underground stolons, which is essential for spreading over short distances and for the stabilization of newly originated types (e.g., in *U. dioica*; Hara & Šrůtek, 1995; Oñate & Munné-Bosch, 2009).

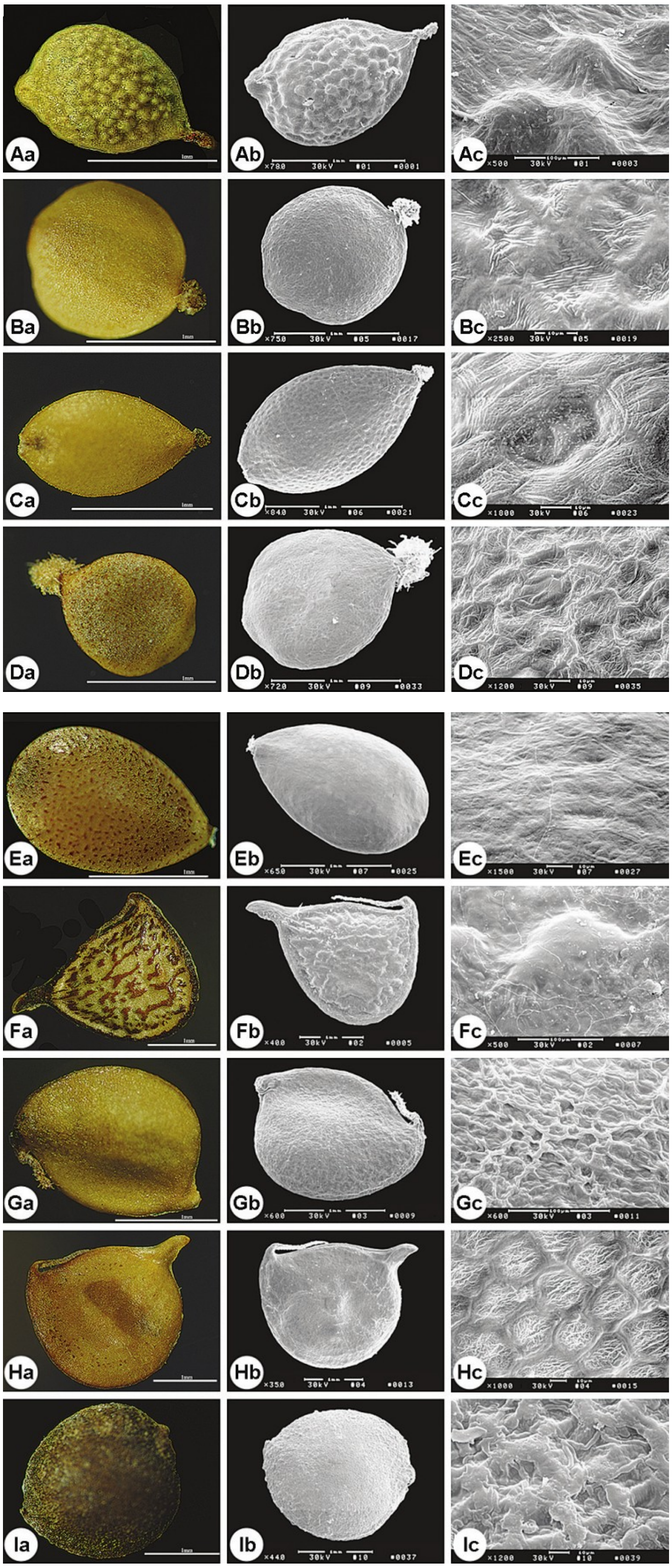

Figure 7. Examples of the morphology and surface structure of the achenes in tribe Urticeae **(A)** *Zhengyia shennongensis* T. Deng, D. G. Zhang & H. Sun; **(B)** *Urtica mairei* H. Lév.; **(C)** *Urtica dioica* L.; **(D)** *Urtica fissa* E. Pritz.; **(E)** *Urtica urens* L.; **(F)** *Laportea bulbifera* (Siebold & Zucc.) Wedd.; **(G)** *Laportea cuspidate* (Wedd.) Friis; **(H)** *Laportea canadensis* (L.) Wedd.; **(I)** *Girardinia diversifolia* (Link) Friis; **(a)** dissecting microscope; **(b)** SEM, low magnification; **(c)** SEM, the ultrastructure of seed surface (the picture adopted from Deng *et al.*, 2013).

3. INTRASPECIFIC CLASSIFICATION OF *URTICA DIOICA*

Most of the previous taxonomic treatments (Domin, 1944; Weigend, 2005) distinguished many subspecies and varieties solely on the basis of marginal morphological differences, causing the taxonomic concept to be unstable and varying among sources. In contrast, recent research (Henning *et al.*, 2014; Grosse-Veldmann & Weigend, 2015; Grosse-Veldmann *et al.*, 2016b) recognizes only seven subspecies within *Urtica dioica*. In Europe, tetraploids are mostly referred to as *U. d.* subsp. *dioica* (Table 1), and other three subspecies (*Urtica dioica* subsp. *pubescens*, subsp. *subinermis*, subsp. *sondenii*) are recognized at the diploid level with different geographical ranges (Table 1) and habitat preferences. Additionally, in the contiguous areas of Southwest and Central Asia, two other related diploid subspecies are distinguished (*Urtica dioica* subsp. *kurdistanica* Chrtek and subsp. *afghanica* Chrtek; Weigend, 2006). The last subspecies *U. d.* subsp. *cypria* (Meikle, 1985; Weigend, 2006) is from the range of the Mediterranean endemic species (*Urtica atrovirens*, *U. bianorii* and *U. rupestris*) related to *U. dioica* (Grosse-Veldmann *et al.*, 2016b). Clues to the delimitation of taxa are given by differences in their genome size (Table 1).

3.1. Nominate subspecies

Urtica dioica subsp. *dioica*

Perennial herbs with a wide range of morphological and ecological variability. In general, the individuals are characterized by distinctively square, straight, non-branching stem with creeping, yellowish stolons in the lower part. The entire height of the plants can reach up to two meters. The leaf lamina is ovate to lanceolate, cordate at the base, acuminated at the apex, with serrated to coarsely serrated, rarely toothed edges (Fig. 8A). The stipules are loose with lanceolate to ovate shape. All parts of the plant are usually covered with stinging trichomes (especially on the stem and the underside of the leaves with concentration on the leaf veins) and unicellular trichomes (rarely glabrous). The plants are dioecious (very sporadically monoecious individuals can be found) with pensile, pistil raceme (Fig. 9A) or erect, anther panicle (Fig. 9B) inflorescences. The fruit is achene of oviform shape, grayish to light brown in color and matte (rarely slightly shiny; detail of the achene in Appendix IV; Chrtek, 1979, 1997; Werner, Rothmaler, & Jäger, 2002; Weigend, 2005; Rothmaler *et al.*, 2007; Goliašová, 2016; Kaplan, 2019).

The taxon originally comes from Eurasia from where it has spread to other temperate regions of the world. It is very abundant, especially in Central Europe, where it often forms continuous and dense vegetation. It can also be found in other parts of Europe, temperate Asia and North Africa (the lower frequency in stated areas may be related to a limited source of moist or nutrient soils; Meusel *et al.*, 1965; POWO, 2022). *Urtica dioica* subsp. *dioica* was introduced mainly to North and South America, South and East Africa, New Zealand and eastern Russia (Grosse-Veldmann *et al.*, 2016a; POWO, 2022). Typical habitats are often affected by human activity (rubble sites, in the surroundings of unmaintained areas in settlements, habitats related to cattle farming, along the roads and paths; Fig. 8B), and with a higher proportion of nutrients in the soil. The more natural populations mainly occur in humid floodplain forests, around and in the vicinity of watercourses and in ravine forests (Ivins, 1952; Geltman, 1986; Chrtek, 1997; Šrůtek & Teckelmann, 1998; Kaplan, 2019).

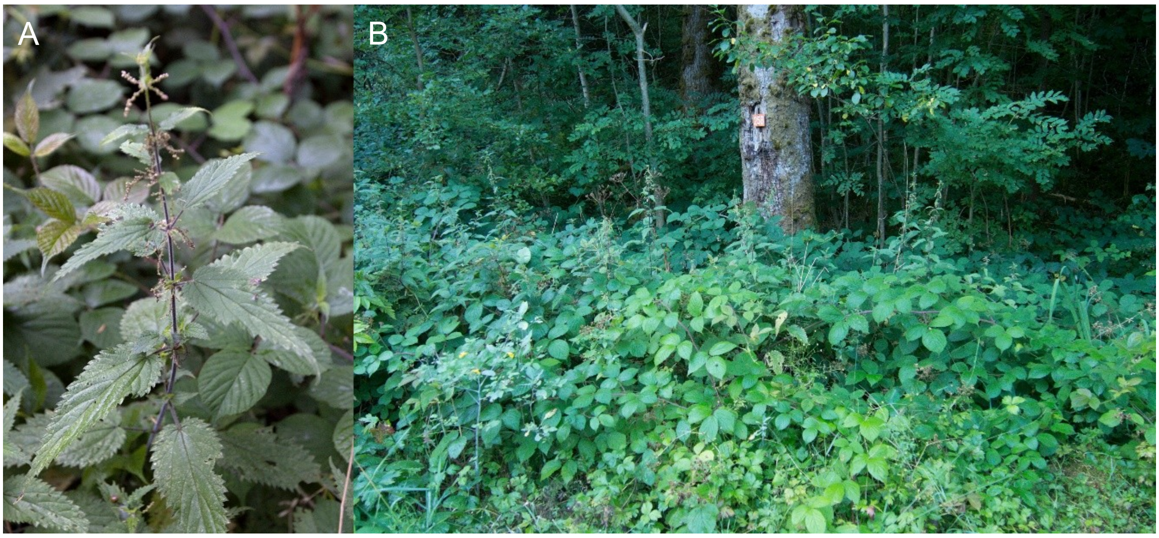

Figure 8. Tetraploid *Urtica dioica* subsp. *dioica* **(A)** and one of its typical habitats of occurrence **(B**; the edge of the forest path, near the village "Mont-Dore", central France; photo by Zuzana Chumová).

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Table 1. Summary of absolute genome size of *Urtica dioica* L. and related species and the number of chromosomes from various literary sources.

Taxon	Occurrence	Mean Cx-value (pg) ± SD*	2C-value range (pg)*	Chrom. number (2n)
U. d. subsp. *dioica*	cosmopolitan[#]	0.55 ± 0.04	2.08–2.20	26[3], 48[8, 9, 5, 10, 2] 52[11, 1, 8, 9, 4, 3]
U. d. subsp. *dioica* – 3x	—	0.54	—	39[11]
U. d. subsp. *dioica* – 5x	—	—	—	65[11]
U. d. subsp. *kurdistanica* Chrtek	Southwest Asia (Anatolia), Iraq, Iran, Syria, and Turkey[$]	0.59 ± 0.01	1.15–1.20	—
U. d. subsp. *pubescens* (Ledeb.) Domin	Astrakhan region (European part of Russia), Po river basin (northern Italy), Bulgaria, Romania, Greece, Turkey and Ukraine[@]	0.58 ± 0.03	1.10–1.21	26[11, 3]
U. d. subsp. *sondenii* (Simmons) Hylander	northern Scandinavia[£]	0.57 ± 0.01	1.12–1.15	26[11,1]
U. d. subsp. *subinermis* (R. Uechtr.) Weigend	Central and Western Europe with contiguous areas of Balkans, Russia and Ukraine[€]	0.58 ± 0.03	1.10–1.25	24[8, 9], 26[11, 8, 9]
Related species				
U. atrovirens Req. ex Loisel.	Corsica, Sardinia, Elba and Mallorca islands, scattered in an area of Italian Tuscany[%]	0.60 ± 0.004	1.18–1.19	26[6]
U. bianorii (Knoche) Paiva	endemic species of Balearic Islands[&]	0.83	—	26[7]
U. cypria (H. Lindb.) Hand	endemic species of the Cyprus Island[§]	0.83 ± 0.005	1.65–1.67	26[12]
U. rupestris Guss.	endemic species of the Sicily Island[©]	0.35	—	26[6]

[*]Genome sizes adopted from Rejlová *et al.*, 2019 – **CS I**; [#]Meusel, Jäger, & Weinert, 1965; POWO, 2022; [$]Chrtek, 1974; Townsend & Guest, 1974; Weigend, 2006; [@]Ledebour*t al.*, 1833; Domin, 1944; Săvulescu & Nyárády, 1952; Geltman, 1984; Weigend, 2005; Rejlová *et al.*, 2019 – **CS I**; Rejlová *et al.*, 2021 – **CS II**; [£]Simmons, 1910; Geltman, 1986, 1992; Jonsell, 2000; [€]Opiz, 1825; Pollard & Briggs, 1984b; Geltman, 1992; McAllister, 1999; Weigend, 2005; [%]Pignatti, 1982; Paiva, 1993; Jeanmonod & Gamisans, 2007; Pignatti *et al.*, 2019; POWO, 2022; [&]Paiva, 1993; POWO, 2022; [§]Meikle, 1985; Weigend, 2006; Christofides, 2017; [©]Pignatti, 1982; Tutin *et al.*, 1993; Fenu *et al.*, 2019; Pignatti *et al.*, 2019; Care Mediflora, 2022; [1]Löve, 1972; [2]Löve, 1981; [3]Geltman, 1981; [4]Woodland *et al.*, 1982; [5]Májovský *et al.*, 1987; [6]Corsi *et al.*, 1999; [7]Corsi, 2000; [8]Lippert, 2000; [9]Lippert, 2006; [10]Gregor, 2009; [11]Rejlová *et al.*, 2019 – **CS I**; [12]Appendix III – unpublished data.

Figure 9. Photo of pensile, pistil raceme **(A)** and erect, anther panicle **(B)** inflorescences of *Urtica dioica* subsp. *dioica* (Nature Monument "Nedošínský háj", Czech Republic; photo by Ludmila Rejlová). Detail of carpellate flowers **(C)** with stigmas and staminate flowers **(D)** with anthers (white arrow) and pistillode (a rudimentary pistil; red arrow) of *Urtica dioica* subsp. *dioica* (photo by Ludmila Rejlová). For more detailed floral morphology within wind-pollinated representatives of the urticalean rosids see Pedersoli *et al.*, 2019.

3.2. Diploid subspecies of *Urtica dioica* in Europe

Urtica dioica subsp. *pubescens* (Ledeb.) Domin

Individuals are characterized by a high density of unicellular trichomes on all parts (Fig. 10A), especially on the stem (Fig. 10C), giving the plants a distinctly dove-grey appearance; stinging trichomes are also present. The representatives in contrast to other diploid subspecies, which occur in less human-affected habitats, grow in drier places and at strongly synanthropic locations that have been intensively agriculturally cultivated (Fig. 10B). A type specimen comes from the Astrakhan region (Ledebour *et al.*, 1833). The geographical range is still poorly known, specimens assigned to this subspecies were collected in Bulgaria, Romania, Greece, Turkey, and Ukraine (Domin, 1944; Săvulescu & Nyárády, 1952; Geltman, 1984; Weigend, 2005). The allopatric occurrence and other issues related to this subspecies are discussed in Section 8.

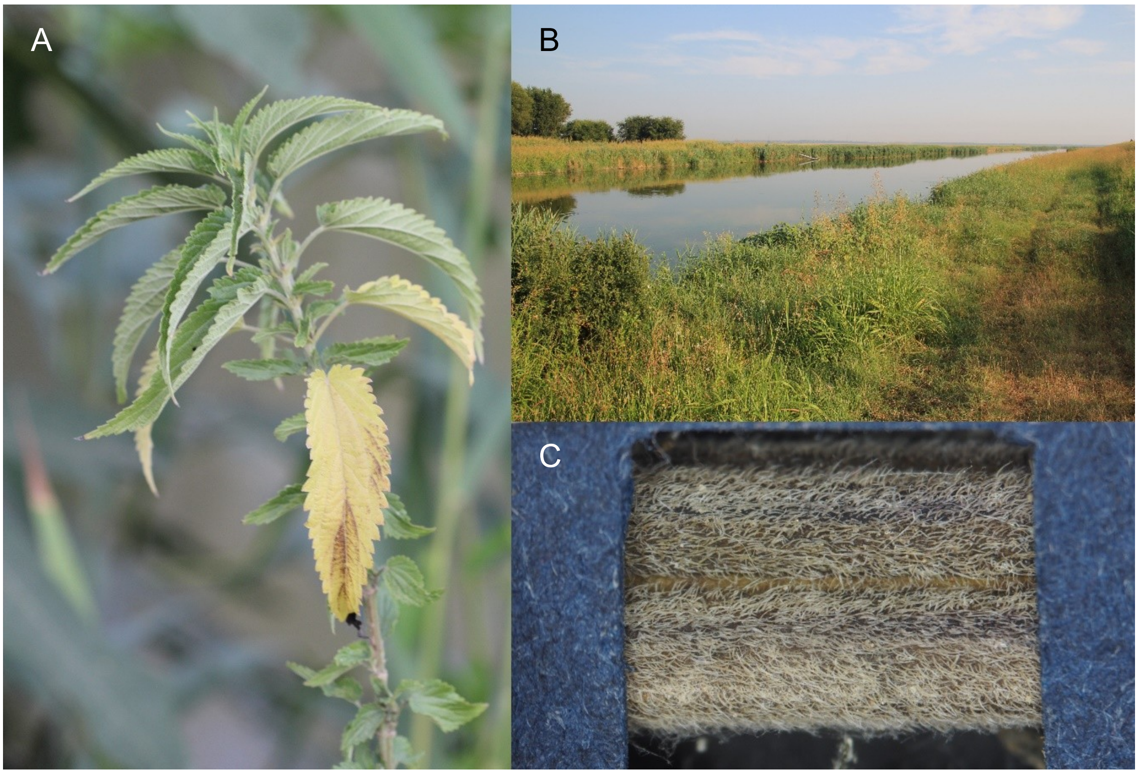

Figure 10. Diploid *Urtica dioica* subsp. *pubescens* (Ledeb.) Domin **(A)** and its typical habitat **(B**; in the vicinity of irrigation drain – the Po Plain, Italy; A and B photo by Tomáš Urfus). The density of the unicellular trichomes on the stem **(C**; photo by Ludmila Rejlová).

Urtica dioica subsp. *sondenii* (Simmons) Hylander

Unlike the other subspecies, the individuals of *U. d.* subsp. *sondenii* are almost completely glabrous (without unicellular trichomes) and with fewer stinging trichomes (Fig. 11B). The plants are described with the typical character of narrow leaves, which is often described in diploids. The center of occurrence is in northern Scandinavia, where it grows in the woodlands, along smaller streams and on scree slopes (Fig. 11A). The area of its distribution partially overlaps with the occurrence of *U. d.* subsp. *subinermis,* and it is sometimes difficult to distinguish each other on the basis of morphology (Simmons, 1910; Geltman, 1986, 1992; Jonsell, 2000).

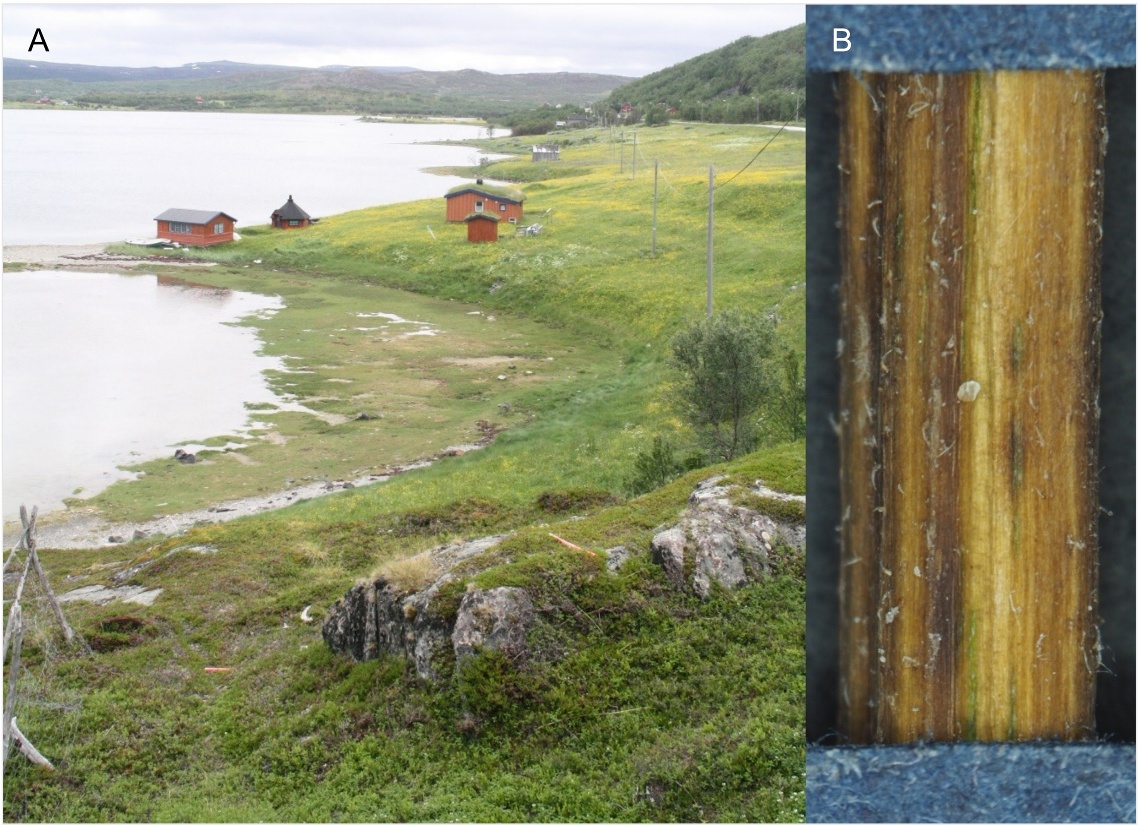

Figure 11. The locality of *Urtica dioica* subsp. *sondenii* (Simmons) Hylander in the northern part of the Scandinavian Peninsula, near the village of "Smørfjord", Norway **(A)** and density of the unicellular trichomes on the stem **(B**; photo by Ludmila Rejlová**)**.

Urtica dioica **subsp.** ***subinermis*** **(R. Uechtr.) Weigend**

syn. *Urtica galeopsifolia* Wierzb. ex Opiz

Plants are characterized by light green colour, elongated leaf lamina, near lack of stinging trichomes, and reduced amount of unicellular trichomes (Fig. 12C). The diploid individuals of *U. d.* subsp. *subinermis* (Fig. 12A) have shifted phenology compared to tetraploid plants of *U. d.* subsp. *dioica* (flowering 14 days later). Typical habitats are mainly along rivers and streams – alluvial habitats and wetland vegetation (Fig. 12B). The overall area of its occurrence includes mainly Central and Western Europe with contiguous areas of Balkans, Russia, and Ukraine, but the literature about its distribution is often contradictory (Opiz, 1825; Pollard & Briggs, 1984b; Geltman, 1992; McAllister, 1999; Weigend, 2005).

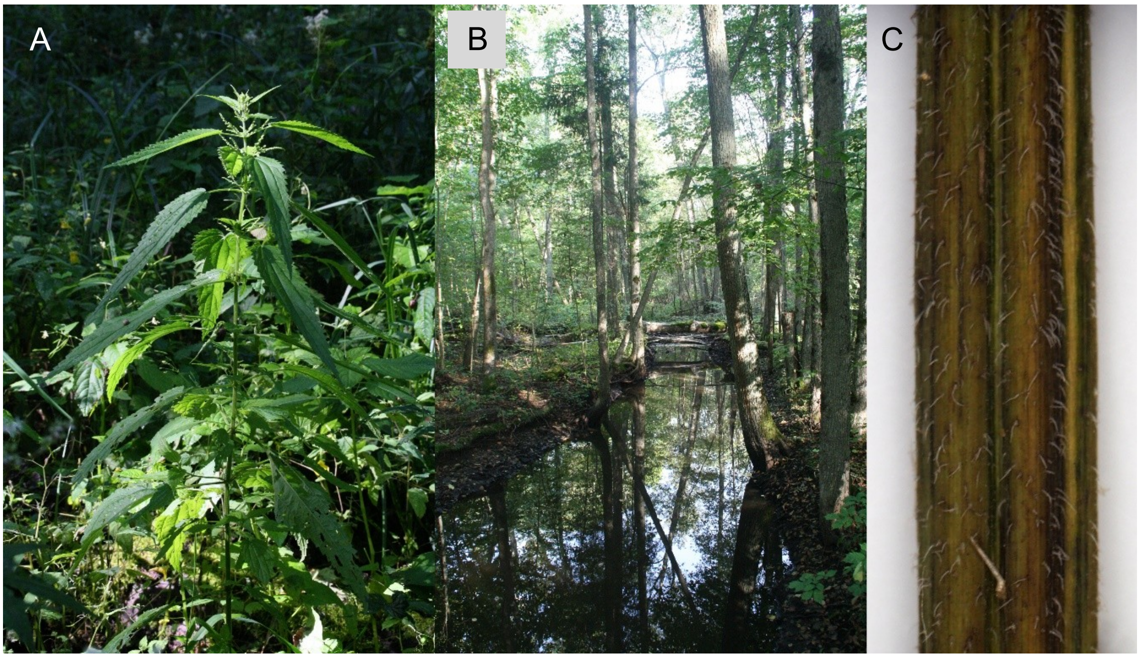

Figure 12. Diploid *Urtica dioica* subsp. *subinermis* (R. Uechtr.) Weigend **(A)** and its typical habitat **(B**, "Ķemeri" National Park – alluvial forests "Meža māja", Latvia). The density of the unicellular trichomes on the stem **(C**; photo by Ludmila Rejlová).

3.3. The Asian diploid subspecies of *Urtica dioica*

***Urtica dioica* subsp. *kurdistanica* Chrtek**

Another subspecies, *U. d.* subsp. *kurdistanica*, is recognized in Turkey, Iraq, Iran, and Syria (Chrtek, 1974; Weigend, 2006). The plants are characterized by a high density of stinging trichomes, mostly on the underside of the leaf lamina (mainly on the midrib and veins) and stem (Fig. 13C), with short unicellular trichomes. They are also fairly easily distinguishable by strikingly dentate leaves, distinctly branched inflorescences, and stiff roots (Fig. 13A). Typical habitats are verges of mountain roads, damp ditches, and gaps between boulders on scree slopes, often at high elevations (Fig. 13B).

In Central Asia, two other diploid subspecies are recognized: *U. d.* subsp. *afghanica* Chrtek and *U. d.* subsp. *gansuensis* C. J. Chen. These subspecies are not a part of the analyzed dataset, and their taxonomic status remains unclear (Chen *et al.*, 2003).

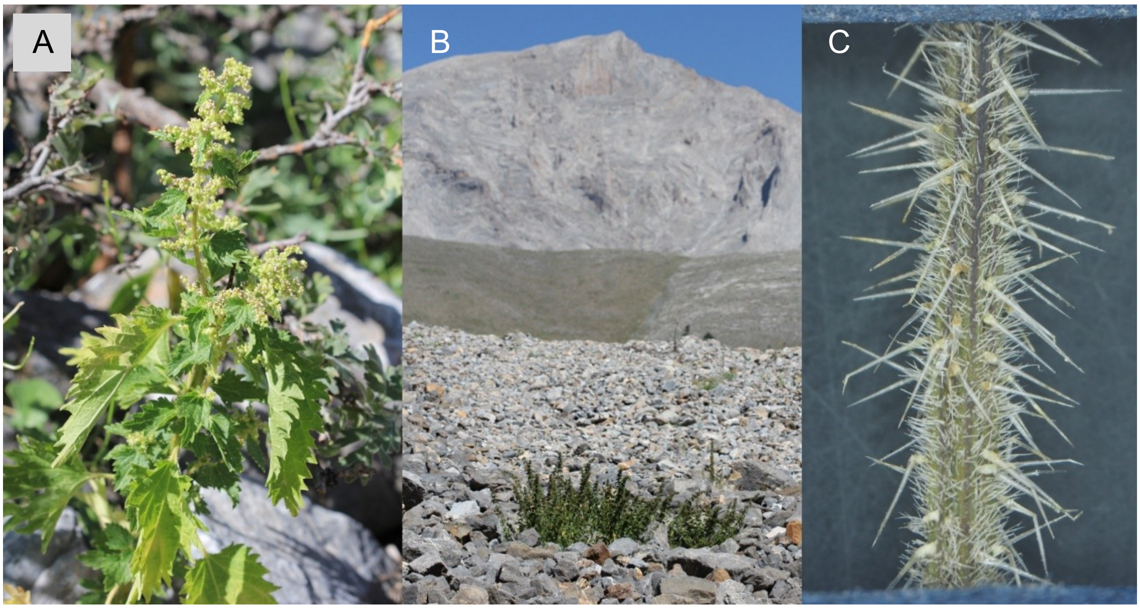

Figure 13. Diploid *Urtica dioica* subsp. *kurdistanica* Chrtek **(A)** and its typical habitat **(B)** Anatolian scree, Turkey; (A and B photo by Tomáš Urfus). The density of the unicellular trichomes on the stem **(C**; photo by Ludmila Rejlová**)**.

4. ENDEMIC SPECIES OF THE GENUS *URTICA* FROM THE MEDITERRANEAN

Urtica atrovirens **Req. ex Loisel.**

It is a monoecious, perennial plant characterized primarily by cordate and sharply dentate leaves with abundant (frequently strikingly yellow and thick) stinging trichomes on the upper surface (Fig. 14A). It grows typically at ruderal sites along roads and walls (Fig. 14B). The center of occurrence are islands in the Tyrrhenian Sea (Corsica and Sardinia), with other specimens reportedly found on Elba and Mallorca and scattered in Italian Tuscany (Pignatti, 1982; Paiva, 1993; Jeanmonod & Gamisans, 2007; Pignatti *et al.*, 2019).

Figure 14. *Urtica atrovirens* Req. ex. Loisel. (**A**; individual U2920 cultivated from seeds; Supporting Table 1 in **CS I**) with detail of dentate leaves **(B)** and typical habitats of occurrence along paths and walls (**C** and **D**; in the vicinity of "Cargèse" region, "Corse-du-Sud", France; photo by Ludmila Rejlová).

***Urtica bianorii* (Knoche) Paiva**

A nettle is of small growth, easily recognizable based on its warty (verrucas) leaf lamina (Fig. 15B), which is due to its noticeable stinging trichomes. The rest of the plant is almost glabrous (lacking unicellular trichomes), with less apparent, scattered stinging trichomes. The leaves are distinctly dentate with a cordate base. It is a monoecious and perennial plant (Fig. 15A), which occurs mostly in nitrogen-rich and shadowed places on rocky outcrops with frequent grazing. The species is endemic to the Balearic Islands (notably found on Mallorca in the "Serra de Tramuntana" Mts at an altitude of 350–1000 m a.s.l.; Paiva, 1993).

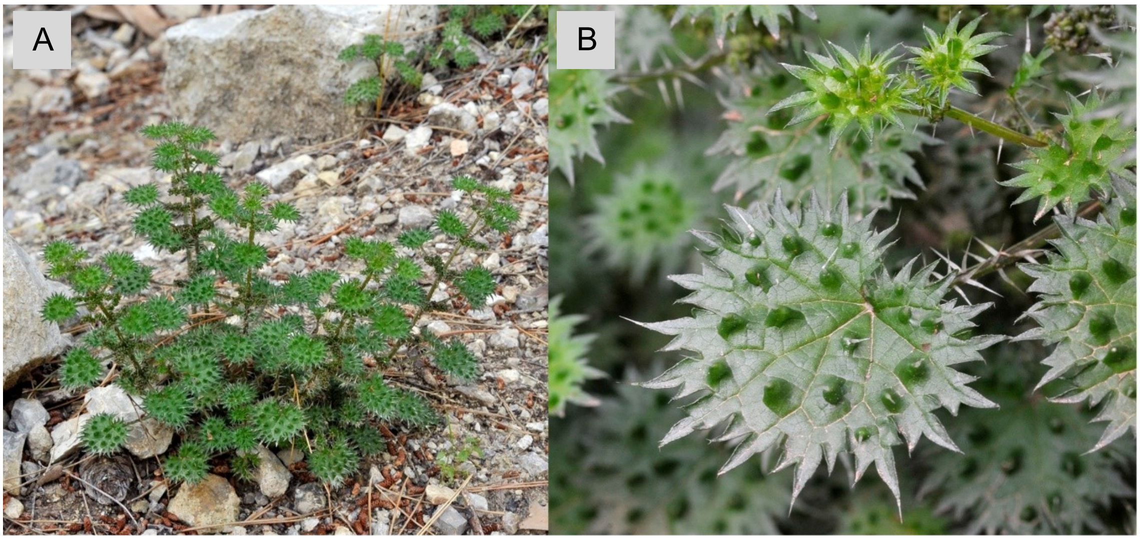

Figure 15. *Urtica bianorii* (Knoche) Paiva **(A)** with detail of verrucas leaf lamina **(B**; photo by Rogier van Vugt©, 2019; Central "Serra de Tramuntana", Mallorca, Spain; file is licensed under the copyright law – free of charge for private and non-commercial educational purposes).

***Urtica cypria* (H. Lindb.) Hand**

The endemic *U. cypria* was initially classified as the other subspecies of *U. dioica* (Weigend, 2006). According to recent knowledge (Hand, 2019), *U. cypria* should be considered a species and assigned to other Mediterranean endemic species of *Urtica* (*Urtica atrovirens, U. bianorii*, *U. rupestris*). The individuals are characterized by scattered stinging trichomes primarily on the veins of underside of the leaf lamina and stem, entirely without unicellular trichomes. The stinging trichomes produce a much more intensive and unpleasant soreness than *U. dioica* proper does, as also mentioned by Hand (2019). The leaves are lanceolate and shallowly dentate. The plants are monoecious, with the male flowers usually in the lower half of the plant and the female ones above (Fig. 16). Plants are mainly found in the western part of Cyprus, and their typical habitats of occurrence are waste ground, moist walls, and field terraces (Fig. 17; Meikle, 1985; Weigend, 2006; Christofides, 2017).

Figure 16. Scanned herbarium specimen of *Urtica cypria* (H. Lindb.) Hand from our own collection (individual U1730; "Polistipos/Alona", Cyprus; collectors Pavel Trávníček and Zuzana Chumová).

Figure 17. The locality of occurrence of endemic *Urtica cypria* (H. Lindb.) Hand on Cyprus, between the villages of "Polistipos and Alona" (photo by Zuzana Chumová).

***Urtica rupestris* Guss.**

The plants have a striking, shiny upper side of the leaf lamina. The leaves are ovate with a rounded base and a toothed edge. Individuals are almost glabrous (without unicellular trichomes) and with scattered or entirely lacking stinging trichomes (on the stem or underside of the leaf lamina). The stem is wooded at the base (Fig. 18A); the plants have distinct male and female individuals (dioecious; individuals with a transient sexual state have also been recorded for more detail see Grosse-Veldmann & Weigend, 2018 and **CS III**). The typical habitats of occurrence are rocky outcrops within mesophilic holm oak woods, often on carbonate substrates (Fig. 18B), at an altitude of 0-600 m a.s.l. It is endemic to the Hyblaean Mts in southeastern Sicily; Pignatti, 1982; Tutin *et al.*, 1993; Fenu *et al.*, 2019; Pignatti *et al.*, 2019).

Figure 18. *Urtica rupestris* Guss. (**A**; individual U4213 from cultivation; collector Eliška Havlíčková, photo by Ludmila Rejlová) with detail of leaf lamina (**B**; photo by Zuzana Chumová). The locality of occurrence (**C**; "Riserva naturale integrate Grotta Monello", Sicily, Italy; photo by Ludmila Rejlová).

5. AIMS OF THE THESIS

This study aims to elucidate the evolutionary importance of polyploidy and evaluate intraspecific variation within the European members of the *Urtica dioica* aggregate and its related congeners. The study is based on comprehensive and extensive sampling, including all of the currently recognized European subspecies, along with related subspecies from Southwest Asia as well as other *Urtica* species outside the complex primarily from the Mediterranean Basin. Long-term taxonomic inconsistency and confusion in the last decades call for a large-scale cytogeographical study of *U. dioica* followed by a detailed morphometric evaluation of cytometrically analyzed individuals and subsequent molecular analyses. To fulfill this task, I have come up with two general work packages:

WP1) *Urtica dioica* is a diploid-polyploid species with several diploid subspecies mostly described from remote and partly relict geographical ranges. Information about their distribution is limited and often contradictory. In contrast, tetraploid individuals are adapted in a variety of synanthropic, nutrient-rich habitats, and their distribution is almost cosmopolitan. To assess the geographical pattern of ploidal variation, genome size variation, and habitat preferences within the complex of *U. dioica* across Europe and adjacent areas, the following questions have been asked along with proposed corresponding hypotheses:

- What is the general cytogeographical pattern of *U. dioica* in Europe (and contiguous areas)? (**CS I**)

  H0: The cytotypes are evenly and randomly distributed.

- Is the genome size a suitable marker for resolving current taxonomic ambiguities? (**CS I, III**)

  H0: Variable genome size is a suitable taxonomic marker even in homoploid taxa.

- Is there a gene flow between dominant cytotypes? If so, how common is hybridization? (**CS II**)

  H0: There is a complete reproductive isolation between the cytotypes.

- Do certain cytotypes occur in particular habitats? Do diploid taxa have a specific habitat preferences? (**CSI**)

  H0: The cytotypes are equal in habitat preferences.

WP2) The intraspecific classification of *U. dioica* is unstable and varies between sources. It includes several morphologically, geographically, cytologically and ecologically more or less well-defined taxa, recently treated mostly at the subspecific rank. However, no detailed morphometric study has been performed. To investigate the long-term taxonomic inconsistency and confusion in the *U. dioica* clade in the context of detailed morphometric examination and the ploidy level of examined individuals, the following questions have been asked and hypotheses proposed in this work package:

- What are the delimitation and relationships among European and Southwest Asian diploid taxa growing in a diverse range of 'primary' habitats? (**CS II**)

  H0: All diploids represent separate taxonomic units.

  H1: European lowland diploids with overlapping areas are more closely related to each other than to the mountain Asian diploid.

- Is the morphological and genetic pattern in congruence i.e., is the morphological differentiation mirrored in the genetic pattern and vice versa? (**CS II**)

  H0: Morphological and genetic differentiation of the taxa is in accordance.

- Is there a differentiation in phenotype plasticity between di- and tetraploids? (**CS II**)

  H0: Tetraploids have higher phenotype plasticity than diploids.

- Has the formation of tetraploids been preceded by hybridization among diploids? (**CS II**)

  H0: Tetraploids are of allopolyploid origin.

6. METHODS

To accomplish the main aims of the study, a combination of several different methodological approaches was necessary. All of the case studies are based on the extensive cytogeographical study that verified the DNA-ploidy level of individuals with the subsequent calibration of absolute genome size by flow cytometry (Doležel *et al.*, 2007; with internal standard *Bellis perennis* L. 2C = 3.38 pg; Schönswetter *et al.*, 2007). This method allows to analyze a large number of samples over a short period of time, which is crucial for examining of widespread species (such as *Tripleurospermum inodorum* (L.) Sch. Bip.; Čertner *et al.*, 2017) with a high number of intraspecific taxa. However, it is a method detecting the DNA-ploidy level in cell nuclei, but it is not able to detect the exact chromosome morphology with possible chromosomal aberrations, anomalies and disorders (such as B-chromosomes, etc.; Rosado *et al.*, 2009). Therefore, all ploidy levels were also verified by chromosome counting (Mandáková & Lysak, 2016; **CS I**).

The field observation indicated a possible differentiation of major cytotypes (diploid and tetraploid ploidy level) in an ecological niche. To evaluate and grasp the ecological preferences of the cytotypes, the Bioclim algorithm on spatially stratified data with nineteen bioclimatic variables has been used as described by Chumová *et al.* (2017). Additionally, to assess the distribution of particular ploidy levels throughout the geographical gradients, the correlation of relative fluorescence intensity with altitude, latitude, and longitude has been used (**CS I**).

Within the extensive sampling, most of the described rare diploid subspecies have been obtained and subjected to an evaluation of morphological variability (multivariate and geometric morphometrics; Koutecký, 2015; Klein & Svoboda, 2017), together with selected tetraploid individuals (evenly covering the species' distribution area). This supplemented the molecular analysis and contributed to assessing the legitimacy of the taxonomic concept. In total, 34 characters were measured and scored, combining those commonly used in the relevant literature (Tutin, 1964; Chrtek, 1974; Townsend & Guest, 1974; Pignatti, 1982; Paiva, 1993; Jonsell, 2000; Weigend, 2005; Grosse-Veldmann & Weigend, 2015; Grosse-Veldmann *et al.*, 2016b) in addition to those that were deemed significant during the field and herbarium studies. The data evaluation took place first at the diploid level and then on the whole dataset. In addition to principal component analysis (PCA), a canonical discriminant analysis (CDA) was performed only with regard to the ploidy level, due to a lack of independent markers or traits that would unambiguously assign all individuals to a particular taxon. The same dataset (di- vs. tetraploid) was used in geometric morphometric to evaluate the shape of leaves. The six main landmarks, along with 50 additional equidistant semilandmarks, were used to characterize the overall shape. Distances between main landmarks on the leaves were also used as characters in the previous multivariate morphometrics (**CS II**).

To evaluate phylogenetic relationships, target enrichment combined with genome skimming (Hyb-Seq approach) was used. This method provides several hundreds of usable low-copy nuclear loci in addition to flanking regions, high-copy repeats and organellar genomes. The wide range of genomic data is suitable for a phylogenomic study (Weitemier *et al.*, 2014; Yu *et al.*, 2018) to distinguish individual lineages (species, subspecies, cytotypes) within *U. dioica* (such as Gernandt *et al.*, 2018; Villaverde *et al.*, 2018). Low-copy nuclear (LCN) probes for target enrichment were designed based on a combination of transcriptome and genome skimming data. To gather the hundreds of orthologous low-copy loci the script Sondovač (Schmickl *et al.*, 2016) was used. Subsequently, SNP sites have been extracted from the obtained Hyb-Seq data (Page *et al.*, 2016; **CS II**). The use of RAD-Seq (restriction site-associated sequencing) methodology was also considered as suitable for phylogenetic studies below the genus level, although with lower data recovery from the other genomic data (Yu *et al.*, 2018). However, the method was considered as inappropriate, because according to Grosse-Veldmann (2016), this approach failed to unravel the intraspecific relationships within the *U. dioica* and managed to confidently separate only the related species *U. kioviensis*.

For more details and individual protocol modifications, see the relevant methods part of the case studies.

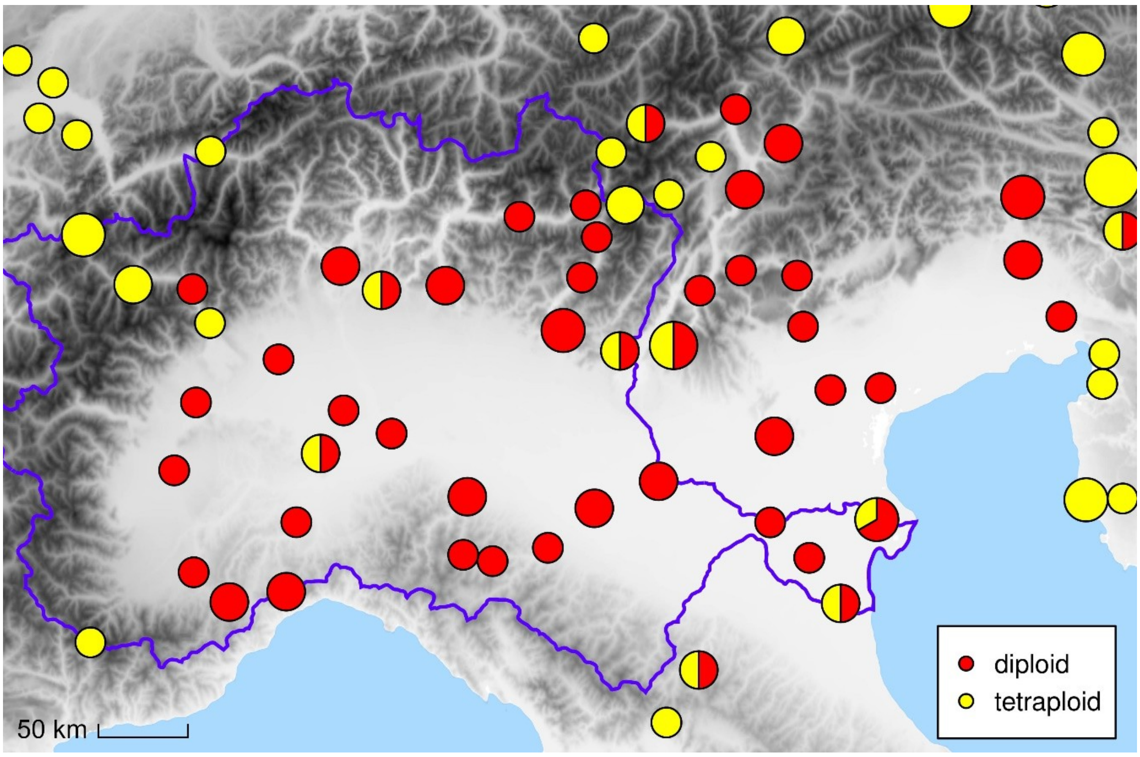

Figure 19. Map of locations of *Urtica dioica* samples collected in the Po Plain (**CS II**). The size of the circles reflects the number of populations. The blue line indicates the outline of the Po river basin.

7. KEY RESULTS

The detailed field observation and extensive sampling of the polyploid complex of *U. dioica*, along with the multiple methodological approaches have been used to contribute to the clarification of long-lasting taxonomic inconsistencies in relation to various evolutionary processes in the genus *Urtica*. The particular results are discussed in more detail and context:

1) Cytogeography of *Urtica dioica*

- The extensive cytogeographic study, which included a total of 7012 individuals from 1317 populations, revealed two dominant ploidy levels (diploids and tetraploids). The widespread tetraploid cytotype (87%) was significantly prevalent over the diploids (13%). For the first time, also very rare triploids (8 individuals) and pentaploids (4 individuals) in a population with co-occurrence of diploids and tetraploids have been captured (**CS I**).
- The rare ploidy levels were also detected in seed analyses (open pollinated seeds collected in the mixed-ploidy population) conducted to explore the possibility of heteroploid hybridization. The frequency of the triploid seeds (18% from diploid and 3% from tetraploid maternal plants) was higher than expected according to the frequency of captured adult triploid plants. The most convincing explanation for this disproportion is related to the triploid block. Furthermore, the evaluation of the ploidy level of the endosperm suggests that gene flow between the two cytotypes can occur (unreduced gamete of tetraploid maternal plant fused with reduced gamete of diploid plant and produced a pentaploid individual with 9x endosperm; **CS I**).
- In the frame of the cytogeographic study, the absolute genome size was estimated in intraspecific taxa of *U. dioica* and related species. The diploid subspecies (*Urtica dioica* subsp. *kurdistanica*, *U. d.* subsp. *pubescens*, *U. d.* subsp. *sondenii*, *U. d.* subsp. *subinermis*) were indistinguishable whereas the related species (*Urtica bianorii*, *U. cypria*, *U. kioviensis*, *U. simensis*; except for *U. rupestris* which showed lower values) had significantly greater and mutually differing values (Table 1). This may be indicative of genetic divergence and partially supporting the molecular data. For most of the taxa, this was the first estimation of genome size (**CS I**).
- During the extensive sampling, an unexpectedly common occurrence has been revealed in the Po Plain (northern Italy). Here the diploid subspecies *U. d.* subsp. *pubescens* significantly dominates (salient contrast of 70% of diploids in the Po Plain contra 13% diploids in the entire cytogeographical sampling area; Fig. 19) and the tetraploid cytotype (assigned to *U. d.* subsp. *dioica*) is spread only at higher elevations of contiguous alpine mountains (**CS I**).

2) Ecogeographic differentiation in *Urtica dioica*

- Based on bioclimatic modeling, assessment of individual locations, and correlation of relative fluorescence intensity with latitude and longitude, the ecogeographical preferences of individual ploidy levels (di- and tetraploids) were examined. The diploid individuals often reported from 'relict' habitats, evince the narrow ecological niche, preferring lower elevation with less human-affected habitats compared to the ubiquitous, synanthropic tetraploid cytotype. Nevertheless, the variability of a particular cytotype is independent due to diploid plants growing mostly in mixed populations with the tetraploid cytotype, which evinces a high degree of plasticity (e.g., ecological or morphological) shared with diploid individuals (**CS I**).
- A special case is the diploid subspecies *U. d.* subsp. *pubescens* from the Po Plain, which occurs exclusively in highly synanthropic and strongly human-affected locations. This is related to deforestation and long-term agricultural usage of the Po Plain (Marchetti, 2002). Currently, only fragments of native and semi-natural alluvial vegetation remain in the river basin (**CS I**).

3) Assessment of morphological variation in *Urtica dioica*

- Principal component analysis at the diploid level was able to distinguish the subspecies, each forming a more or less separated cluster. When analyzing the entire polyploid dataset (also including the tetraploid accessions) in the same manner, the tetraploids substantially overlapped with diploids. Only the diploid individuals from the Po Plain (*U. d.* subsp. *pubescens*) and diploids from Anatolia (*U. d.* subsp. *kurdistanica*) form partly distinct clusters, which reflects their geographical isolation (**CS II**).
- Subsequent canonical discriminant analyses (individual plants assigned to groups based on the ploidy level) has shown only a marginal differentiation of the two cytotypes. The most contributed characters are associated with the density of unicellular trichomes (in particular, the density of unicellular trichomes on the reverse and upper side of the leaf and on the stem; **CS II**).
- The same dataset was used to evaluate of the shape of leaves. The individuals in the PCA were categorized by ploidy level (diploid vs. tetraploid) because diploids are often described as having narrow leaves compared to tetraploids. The resulting pattern shows a large overlap between the groups, lacking any structure (**CS II**).

4) Phylogenetic relationships in *Urtica*

- Subsequent molecular analyses did not confirm the differentiation of diploid subspecies, as was observed in the case of morphometric analyses. The molecular evaluation did not reveal any structure and tetraploids also merged with diploids in morphological analyses (**CS II**). The possible causes of incongruences between the molecular and morphometric datasets are discussed in Section 8.
- Extraction of single nucleotide polymorphisms from Hyb-Seq data showed a clear differentiation of tetraploid individuals from the Middle East, which also corresponded to the splitting of tetraploids into two separate branches of the species tree (**CS II**).
- Within the collection of all currently described subspecies of *U. dioica* in Europe, the endemic *U. cypria* was included in the analyses. So far, the individuals from Cyprus had been considered as a subspecies of the *U. dioica* complex (*U. d.* subsp. *cypria*). However, the molecular data (target enrichment combined with genome skimming – Hyb-Seq) combined with different morphology, chromosome counts (Appendix III), and nuclear genome size estimation support the elevation to the species rank and the assignment to other Mediterranean endemic species of the genus *Urtica* **(CS II**, **CS III** – unpublished data).

5) Other significant results

- On closer inspection of the newly discovered location of endangered *U. kioviensis* in the Czech Republic (Nature Reserve "Plačkův les a říčka Šatava" in southern Moravia), hybrid individuals of *U. dioica* × *U. kioviensis* were found in sympatric occurrence with the parents (DNA ploidy level of tetraploid cytotype of *U. dioica* – 2C = 1.94 pg; diploid *U. kioviensis* – 2C = 1.14 pg, hybrid individuals – 2C = 1.53 pg). The hybrid individuals had a partly intermediate appearance, as well as an intermediate genome size, which can be used as a taxonomic marker (Appendix I and II).
- Based on the cytogeographical screening in related species, polyploidy was also revealed in *U. pilulifera* L. and *U. atrovirens* (unpublished data). This indicates that polyploidy within the genus *Urtica* will probably be more common than previously estimated, however, there is no clear evidence that the polyploidy leads to significant diversification in the genus *Urtica*.

8. DICUSSION

A combination of multiple biosystematic methods has been applied to contribute to clarifying the variability of the *U. dioica* group. Only such an integrative approach can bring a new perspective to long-term taxonomic inconsistencies and confusions within the group and make it more transparent. During the extensive-scale screening across Europe and adjacent regions, a sufficient set of samples has been collected in order to investigate the cytogeographical distribution, morphological differences, habitat preferences, geographical delimitation and phylogenetic relationships within this group. Nevertheless, due to high variability and plasticity throughout the group, the distinction of the taxa is complicated.

Source of confusion in the European diploid taxa

Urtica dioica is a widespread species which is reported from almost the whole temperate zone of the world (Meusel *et al.*, 1965; Woodland, 1982; Tutin *et al.*, 1993; Chen *et al.*, 2003; Grosse-Veldmann *et al.*, 2016b; POWO, 2022). The original distribution area of *U. dioica* is obscured by a secondary occurrence, mainly due to their weediness character and introduction by human activity (Domin, 1944; Geltman, 1986; Šrůtek & Teckelmann, 1998); therefore, the original area cannot be determined with confidence. However, as it is a widespread species and the literature about the distribution of particular subspecies and ploidy levels is often contradictory (Geltman, 1981, 1986; Pollard & Briggs, 1982; Weigend, 2005; Grosse-Veldmann & Weigend, 2015), an extensive ploidy screening has been performed (**CS I**). The large-scale sampling combined with the fast and affordable method of flow cytometry allowed to unequivocally distinguish widespread tetraploids, suppress their overall distribution, and unblur the spatial pattern of diploids. Additionally, it contributed to the delimitation of the occurrence of the currently recognized diploid subspecies in *U. dioica* (*U. d.* subsp. *kurdistanica*, *U. d.* subsp. *pubescens*, *U. d.* subsp. *sondenii*, and *U. d.* subsp. *subinermis*; **CS I**). Previously, the taxa were often recognized based on their morphological appearance (Domin, 1944; Weigend, 2005), despite the fact that they frequently grow in mixed populations where tetraploids (*U. d.* subsp. *dioica*) prevail and evince a high degree of plasticity (e.g., ecological and morphological) shared with diploid individuals (**CS I and II**). The geographical distribution of some of the subspecies is more or less clearly defined, especially the occurrence of *U. d.* subsp. *pubescens* in the Po Plain and *U. d.* subsp. *kurdistanica* in Anatolia, with significant geographical barriers. However, the areas of occurrence of the other two subspecies (*U. d.* subsp. *sondenii* and *U. d.* subsp. *subinermis*) partially overlap, and it is difficult to distinguish each other on the basis of morphology or genome size (**CS I and II**). Moreover, in the morphological part of the study, plants intermediate between these subspecies have been collected in the region between Norway and Finnish Lakeland. A similar case of possible hybridization was described by Geltman (1992) between individuals of *U. d.* subsp. *subinermis* (syn. *U. galeopsifolia*) and *U. d.* subsp. *sondenii*. The contact of these two subspecies is attributed (according to Geltman 1986) to a far more widespread distribution of the *U. d.* subsp. *sondenii* not only in Scandinavia but also in Central Siberia and their ability to grow in similar habitats. In the molecular analyses (Hyb-Seq data and SNPs analyses; **CS II**), the individuals of subsp. *sondenii* have been partially separated from the rest of the diploid subspecies of *U. dioica* (**CS II**). The individuals sharing an intermediate position between *U. d.* subsp. *subinermis* and *U. d.* subsp. *pubescens* have been also found along the biogeographical border between Mediterranean hills and Dinaricplateaus in southwestern Slovenia. Intermediate plants between these parental subspecies were also reported by Geltman (1986) along the river of the Volga in the Saratov region in southern European Russia. Contact zones are likely to be more frequent and can complicate the hitherto unresolved phylogenetic relations at the subspecies level of *U. dioica* (Henning *et al.*, 2014; Grosse-Veldmann *et al.*, 2016b; **CS II**). Although hybridization between diploid subspecies of *U. dioica* is yet to be proven experimentally, it seems very likely, as hybrids have been confirmed, for example, between *U. dioica* and *U. kioviensis* (Buchwald *et al.*, 2013; Rejlová & Urfus, 2018 – Appendix I; Karlsson & Agestam, 2019). Moreover, the possibility of heteroploid hybridization in seed analysis has been explored and provided evidence of inter-cytotype crossing in *U. dioica* (**CS I**). The lack of genetic divergence at diploid level, despite having a range of morphological differences, might suggest relatively recent differentiation (early stages of divergence; Wu *et al.* 2018 estimating the origin of the crown clade at 2.4–2.0 Mya, cf. to the most basal species of the genus *Urtica* to ca 26.2 Mya–up to the present). This could have been followed by fragmentation of a large ancestral geographical range, rapid expansion from a limited number of source populations, or life-history traits such as obligate outcrossing, wind pollination (i.e., possible long-distance dispersal of pollen grains; Ranta *et al.*, 2008) and vegetative spread by underground stolons (Winkler & Fischer, 2002; Wright & Davis, 2006; **CS II**). For the research, the Hyb-Seq approach to next-generation sequencing was used, which usually provides robust phylogenetic trees based on hundreds of genes. The resolution power of the method may be limited depending on the marker used, since the Hyb-Seq primarily targets conserved regions in the genome. However, similar studies using Sanger sequencing (Henning *et al.*, 2014; Grosse-Veldmann *et al.*, 2016b) or based on the so-called RAD-Seq technique (Grosse-Veldmann, 2016) provided similar results. Both methods based on NGS-approaches are versatile and allow their use for deep and shallow taxonomic units (Mandel *et al.*, 2017; Gernandt *et al.*, 2018; Villaverde *et al.*, 2018). These multiple proofs corroborate the hypothesis that these failures to differentiate taxa are of a systemic nature associated with the life history of *U. dioica* s.l., not caused by methodological biases.

Disjunct geographical distribution of *Urtica dioica* subsp. *pubescens*

During the extensive sampling, an unexpectedly common occurrence in the Po Plain has been revealed, where *U. d.* subsp. *pubescens* significantly dominates (**CS I**). The individuals assigned to this subspecies have been reported in the past from Southeast Europe and reaching westwards to Italy (Weigend, 2005), but not to such an extent.

The type specimen comes from the Astrakhan region (Ledebour *et al.*, 1833), and Geltman (1986) even treated this taxon as endemic to the Volga river delta. By detailed morphological examination of the items (obtained from D. Geltman, St. Petersburg), the individuals fall into a well-separated cluster of *U. d.* subsp. *pubescens* in the morphometrics analysis (**CS II**). Unfortunately, it was not possible to verify the ploidy level (other plants from the region were proved to be diploid, Geltman pers. comm.) or obtain any molecular data from the items. Moreover, when investigating the original locations in the Volga river delta, no individuals were found. As a result, it was impossible to provide an acceptable explanation for this disjunction and prevalence of diploids in the Po Plain.

Origin of tetraploid cytotype

In the cytogeographical study, the predominance of tetraploid cytotype (mostly referred to as *U. d.* subsp. *dioica*) has been confirmed, which widely occurs in various synanthropic habitats and has a cosmopolitan distribution (Meusel *et al.*, 1965; POWO, 2022; **CS I**). Subsequent molecular analyses (Hyb-Seq approach) and extraction of SNPs showed a clear differentiation of Middle-Eastern tetraploid individuals. That also corresponded to the splitting of tetraploids into two separate branches of the species tree, comprising European individuals, which merged with all diploids, and plants from Southwest Asia (Anatolia, Iran, and Georgia; **CS II**). The molecular data did not indicate that Asian tetraploids originated from the partly co-occurring diploids assigned to *U. d.* subsp. *kurdistanica*. One possible explanation is that sampling density is low in Asia compared to Europe, which could lead to omitting any ancestral diploids. Another possible explanation is that tetraploids originated from other sympatric diploids (e.g., mentioned diploid subspecies from Central Asia – *U. d.* subsp. *afghanica* and *U. d.* subsp. *gansuensis*; Chen *et al.*, 2003) outside the study area and migrated into the area covered by the study. Finally, the least likely is that hybridization occurred at the tetraploid level.

The examples of the possible spontaneous formation of tetraploids are the tetraploid individuals collected in mixed-ploidy populations with diploids assigned to *U. d.* subsp. *pubescens* in the Po Plain. The absence of any other diploid taxa within the distance of 200 km suggests that the individuals are likely of autopolyploid origin (**CS II**). This hypothesis is supported by the morphometric analysis, where the tetraploid individuals from mixed-ploidy populations either fell into the well-separated diploid cluster of *U. d.* subsp. *pubescens* or formed a separate cluster on the edge of other tetraploids assigned to *U. d.* subsp. *dioica* (**CS II**).

The morphometric evaluation of both ploidy levels shows the overlap between the tetraploids (*U. d.* subsp. *dioica*) and diploids assigned to *U. d.* subsp. *subinermis* and *U. d.* subsp. *sondenii*, which might indicate the participation of these plants in the origin of tetraploids. However, it cannot be excluded the possibility of the formation of tetraploids from a different mixture of allo- and autopolyploid lineages (hybridization among different diploids followed by polyploidization), which hybridize further at 4x level, which might lead to a complicated origin that is difficult to uncover. For European samples outside of the Po Plain, the molecular data do not provide any plausible evidence for the origin of tetraploid individuals due to the lack of variability at both diploid and tetraploid level.

Therefore, it was impossible to elucidate the evolutionary history of these tetraploids, which also reflected the results from the morphometric evaluation and previous complicated taxonomy of *U. d.* subsp. *dioica* in the latest phylogenies (Henning *et al.*, 2014; Grosse-Veldmann *et al.*, 2016b; **CS II**).

Taxonomic consequences

Although the different sets of molecular markers were used and all plants were checked by flow cytometry, no structure within *Urtica dioica* (**CS II**) has been found, as well as in the case of previous phylogenetic studies (Henning *et al.*, 2014; Grosse-Veldmann *et al.*, 2016b). On the other hand, the results have contributed to delimitation within the related species to *U. dioica*. The position of related species *U. kioviensis* and *U. gracilis* was clearly delimited, corresponding to Henning *et al.* (2014), who obtained almost the same topology using ITS (internal transcribed spacer) and chloroplast DNA regions (*trn*S–G, *trn*H–*psb*A and *trn*L–F). The results have also contributed to clarifying the position of endemic *U. cypria* from Cyprus, which had been considered a subspecies of *U. dioica* (Weigend, 2006). However, the molecular data supported by chromosome counts (Table 1, **CS II**, Appendix III), and nuclear genome size estimation (Table 1, **CS I**) suggest separation to the species rank, as previously proposed by Hand (2019). Together, these support their assignment to other Mediterranean endemic species (*Urtica atrovirens*, *U. bianorii*, *U. rupestris*), and confirming the position outside of *U. dioica* s.s. clade. In the first study (**CS I**), the 1Cx-value for *U. cypria* has been estimated incorrectly, because it was expected it to be triploid, as suggested by its genome size compared to other subspecies of *U. dioica*. Besides that, other included species are well-recognizable based on their genome size (Table 1; except *U. atrovirens*, which has the same genome size as the mutually indistinguishable diploid subspecies of *U. dioica*). Genome size can aid in the detection of taxa and may be indicative of genetic distance. One example is *U. bianorii*, which was previously classified as a variety or subspecies of *U. atrovirens* and was often mistakenly identified, while genome size can differentiate it reliably (Paiva, 1993; similar examples in other taxa e.g., Loureiro *et al.*, 2010; Vít *et al.*, 2016; Yan *et al.*, 2016). Additionally, species from the *Urtica* genus can be determined by the differing morphology of their achenes, although this is not applicable at subspecies level (Chrtek, 1979; Wolters *et al.*, 2005; Appendix IV).

9. CONCLUSIONS AND FUTURE PERSPECTIVES

Based on extensive cytogeographic sampling, a corresponding large dataset of samples was obtained to account for the widespread distribution and weediness of the studied species *U. dioica*. A combination of various approaches was used to contribute to exploring the cytogeographical distribution, ecological preferences, morphometric variation and phylogenetic links of the subspecies.

In the overall pattern, the tetraploid cytotype is significantly predominating at the expense of low-abundant diploids and infrequent triploid and pentaploid individuals. Detected rare triploid and pentaploid ploidy levels were also captured in the analysis of seeds. The evaluation of the ploidy of endosperm suggests gene flow between dominant ploidy levels, and indicates heteroploid hybridization, which may future pose a threat to the far less abundant diploid populations due to genetic erosion.

The extent of sampling shed more light on the spatial delimitation of the recognized rare diploid subspecies, as well as their morphological delimitation. Individual diploid subspecies (*Urtica dioica* subsp. *kurdistanica*, *U. d.* subsp. *pubescens*, *U. d.* subsp. *sondenii* and *U. d.* subsp. *subinermis*) form more or less recognizable clusters; however, after the addition of highly morphologically plastic tetraploid individuals (*U. dioica* subsp. *dioica*), their morphological pattern is largely obscured. Consequent discriminant analysis, in which individuals are classified into groups based on the ploidy level, shows that the most contributing characters to distinguishing diploids and tetraploids are associated with the density of stinging and unicellular trichomes on different parts of plants.

Subsequent molecular analyses did not reveal significant diversification in either of the groups, where individuals are assigned based on the ploidy level or within the morphologically distinguishable diploid subspecies. Extracted SNPs clearly distinguish the tetraploids from the Middle East, which corresponds to the split of tetraploids into two separate branches of the species tree. Obtained molecular data also contributes to the delimitation of the related species *U. cypria*, formerly classified as a diploid subspecies of *U. dioica*. As all the molecular approaches used so far have failed to uncover relationships and intraspecific variability within *U. dioica*, future work ought to employ highly sensitive molecular methods such as whole-genome sequencing or oligopaint FISH in order to contribute to the next reveal of the evolution in this polyploid complex.

The correlation with geographic parameters (latitude, longitude, and altitude), Bioclim modeling, and affinity to human-affected habitats reveal, despite the highly variable tetraploid cytotype, certain differences in the ecogeographical preferences of the dominant cytotypes. The diploid populations often found in remote and partly relict geographic ranges usually prefer lower altitudes, have a narrower ecological niche and occur in less human-affected habitats (except for population from the Po Plain assigned to *U. d.* subsp. *pubescens*). In contrast, the ubiquitous tetraploid cytotype thrives in highly synanthropic sites and extends to higher altitudes. Furthermore, further study of ecological preferences in conjunction with other factors, such as rate of clonality, germination, number of seeds of individual ploidy levels, the ability to form a seed bank, etc., can contribute to the understanding of mechanisms of successful widespread distribution of this well-known weed and its impact on surrounding species and communities (especially in Central Europe, where it often forms continuous vegetation).

Other future areas of interest with practical applications include secondary metabolites and compounds isolated from *U. dioica* (e.g., currently increasingly used for the treatment of diabetes and prostate diseases). Their quality and quantity may be conditioned by a number of influences. Their study in the diploid-tetraploid complex of *U. dioica* might contribute to, e.g., comparison of the quality of extracted compounds depending on the ploidy level and its possible further use in applied research, clarify intraspecific variability or contribute to the understanding of defense mechanisms.

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PART B – CASE STUDIES

CASE STUDY I

Polyploid evolution: The ultimate way to grasp the nettle

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Polyploid evolution: The ultimate way to grasp the nettle

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Abstract

Polyploidy is one of the major forces of plant evolution and widespread mixed-ploidy species offer an opportunity to evaluate its significance. We therefore selected the cosmopolitan species *Urtica dioica* (stinging nettle), examined its cytogeography and pattern of absolute genome size, and assessed correlations with bioclimatic and ecogeographic data (latitude, longitude, elevation). We evaluated variation in ploidy level using an extensive dataset of 7012 samples from 1317 populations covering most of the species' distribution area. The widespread tetraploid cytotype (87%) was strongly prevalent over diploids (13%). A subsequent analysis of absolute genome size proved a uniform Cx-value of core *U. dioica* (except for *U. d.* subsp. *cypria*) whereas other closely related species, namely *U. bianorii*, *U. kioviensis* and *U. simensis*, differed significantly. We detected a positive correlation between relative genome size and longitude and latitude in the complete dataset of European populations and a positive correlation between relative genome size and longitude in a reduced dataset of diploid accessions (the complete dataset of diploids excluding *U. d.* subsp. *kurdistanica*). In addition, our data indicate an affinity of most diploids to natural and near-natural habitats and that the tetraploid cytotype and a small part of diploids (population from the Po river basin in northern Italy) tend to inhabit synanthropic sites. To sum up, the pattern of ploidy variation revealed by our study is in many aspects unique to the stinging nettle, being most likely first of all driven by the greater ecological plasticity and invasiveness of the tetraploid cytotype.

Introduction

Polyploidy, sometimes referred to as whole-genome multiplication, is generally considered a major force in plant evolution, producing novelties which may eventually lead to single-step speciation, that is, saltation [1–4]. Moreover, the substantial success of angiosperms, the largest clade of land plants, is attributed to polyploidy [5]. Probably 15% (but at least 2–4%) of all speciation events in angiosperms are estimated to have involved polyploidization [6, 7]. Different ploidy levels can either correspond to already discrete lineages or species [8], or constitute intraspecific variation [9]. Newly established polyploid lineages frequently undergo subsequent diploidization [10–12], which is usually followed by genome downsizing [13–15]. Nevertheless, distinct cytotypes frequently coexist in sympatry and, according to the current state of knowledge, at least 16% of all vascular plant species consist of multiple cytotypes [16].

Polyploidy directly affects a number of key biological features (e.g. cell and plant size and duration of mitosis) ultimately associated with distinct physiology and ecology [17, 18]. Such novelties frequently result in improved adaptation potential, fitness, etc. [19–21], which is further mirrored, for example, by broader ecogeographic and climatic niches of polyploids compared to their diploid or lower-ploidy progenitors [22–24]. Specific features of plants have repeatedly been linked to polyploidy (e.g. phenology, mycorrhizal colonization, pollinator behaviour, herbivore predation, salinity tolerance and migration potential [25–30]). Moreover, polyploid cytotypes tend to inhabit a broad range of synanthropic habitats, in contrast to their diploid congeners (*Arabidopsis arenosa* (L.) Lawalrée, *Cardamine amara* L., *Centaurea stoebe* L., *Solidago gigantea* Ait., etc. [31–35]), and their greater ecological plasticity and synanthropic affinity can increase their invasive potential [36, 37].

The essential first step when gaining insight into the evolution of polyploid plants is cytogeography, the study of cytotype diversity and its past and predicted future distribution patterns [13]. Knowledge of the cytotype distribution pattern usually reveals phenomena such as environmental segregation or reproductive isolation of cytotypes [38–40].

Despite the undisputed evolutionary significance of polyploidy, there is a lack of comprehensive cytogeographical studies, with only a few focusing on widespread weedy plants [41] even though they represent highly suitable model taxa for investigating the evolutionary potential of polyploids (e.g. *Mercurialis annua* L., *Tripleurospermum inodorum* (L.) Sch. Bip., *Senecio inaequidens* DC. [42–45]). Surprisingly, the stinging nettle *Urtica dioica* L., one of the most troublesome polyploid weeds, remains considerably understudied, despite being highly important in agriculture, the textile and cosmetics industries [46–48], and medicine [49, 50]. The species represents a nitrophilous, synanthropic and invasive species with a cosmopolitan distribution [51–53]. *Urtica dioica* is characterized by huge variation mirrored by a high number of intraspecific taxa distinguished either solely based on morphological characters (e.g. various types of indumentum [54–56]) or with consideration for sexual morphs (predominantly stochastically occurring [54, 55, 57]). Finally, polyploidy is a truly substantial source of variation in *U. dioica*. Published diploid chromosome counts frequently refer to plants from relict or semi-natural habitats (e.g. alluvial forests [58–60]) whereas tetraploids have been reported to occur in habitats of various types, even highly synanthropic ones [58, 61–63]. However, even though relatively many chromosome counts have been published (e.g. [64]), the distribution pattern has so far only been studied marginally and locally. Moreover, ploidy levels were not directly considered in recent phylogenetic reconstructions [65–68].

We have adopted the only current taxonomic treatment of *U. dioica* consisting of several subspecies. Apart from the nominate tetraploid and widely distributed subspecies *U. d.* subsp. *dioica*, all subspecies are supposed to be diploid and somewhat restricted in their distribution area: *U. d.* subsp. *kurdistanica* (found in alpine habitats of Anatolia and Near Eastern mountain ranges [69, 70]), *U. d.* subsp. *pubescens* (scattered in lowlands from Italy across the Balkan Peninsula to the delta of the river Volga [71–73]), *U. d.* subsp. *sondenii* (tundra marches [59, 73, 74]) and *U. d.* subsp. *subinermis* (alluvial forests, floodplain forests [54, 55, 71, 75]). Finally, the unique steno-endemic *U. dioica* subsp. *cypria* is treated as a subspecies of *U. dioica* (a single population in Cyprus, population UP1219; S2 Table) even though its morphology is distinct [72, 76]. However, the infraspecific phylogeny of *U. dioica* is still largely unresolved [68] and the ranks of its infraspecific taxa also remain a matter of debate [58]. Three recent phylogenies [65, 67, 68] also place four other taxa within the crown clade of *Urtica* (corresponding to *U. dioica*): *U. atrovirens* Req., *U. bianorii* (Knoche) Paiva, *U. kioviensis* Rogow. and *U. simensis* Hochst. ex A. Rich.

The present study aims to assess the ploidy and genome size variation within *U. dioica* across Europe (with contiguous areas of West Asia). We placed particular emphasis on the following questions: (1) What is the general cytogeographic pattern of *U. dioica* in Europe (with contiguous areas of West Asia)? (2) Is genome size a suitable taxonomic marker for resolving current taxonomic ambiguities? (3) Do certain cytotypes occur in particular habitats?

Materials and methods

Materials

Plant material. Plants were collected between 2012 and 2018 at 1317 localities (1305 localities of *U. dioica* and 12 localities of closely related species) across Europe and West Asia (Fig 1, S1 Table, S1, S2 and S6 Figs). Although the sampling was primarily random, we focused partially on relict and semi-natural habitats (e.g. ravine and alluvial forests, alpine vegetation and tundra marches, Mediterranean mountains) because (partly allegedly) diploid taxa (*U. d.* subsp. *kurdistanica*, subsp. *pubescens*, subsp. *sondenii*, subsp. *subinermis*) were often reported from such habitats [54, 55, 59, 69–75]. In total, 7012 plants (6977 individuals of *U. dioica* and 35 individuals of closely related species) were sampled (5–10 plants per population; the distance between sampled plants was at least 3 m to avoid re-sampling of the same clone). As a rule, fresh leaves were used for flow cytometric analyses, in some cases silica-gel dried leaves were used (~10% of samples). A subset of plants was transferred to the experimental garden of the Institute of Botany of the Czech Academy of Sciences in Průhonice (N49.99474, E14.56617, 320 m a.s.l.) for further cultivation and chromosome counting. Voucher specimens will be deposited in the Herbarium of the Charles University, Prague (PRC). GPS coordinates, the elevation and type of habitat were recorded for each population (S1 Table). The study did not necessitate any specific permissions and did not involve endangered or protected species.

Methods

Flow cytometry. Cytotypes were identified by means of flow cytometry, a technique enabling us to analyse large numbers of samples over a short period and to collect appropriate many samples of all taxa and cytotypes [77]. Relative genome size was ascertained for all plants (S1 Table) and absolute genome size was estimated for a subset of samples (Table 1).

Sample preparation followed a simplified two-step protocol [78]. A part of a petiole was chopped together with the internal reference standard *Bellis perennis* L. (2C = 3.38 pg; [79]) using a sharp razor blade in a plastic Petri dish containing 500 µl of the ice-cold buffer Otto I (0.1-M monohydrate citric acid and 0.5% Tween 20). The suspension was filtered through a 42-µm nylon mesh and the isolated nuclei were stained for 5 minutes with 1 ml of the buffer Otto II (0.4-M $Na_2HPO_4 \cdot 12H_2O$) supplemented with the fluorochrome 4',6-diamidino-2-phenylindole (DAPI; final concentration 4 $\mu g \cdot ml^{-1}$) and ß-mercaptoethanol (final concentration 2 $\mu l \cdot ml^{-1}$).

Absolute genome size was estimated using the intercalating fluorochrome propidium iodide (PI) supplemented with RNase IIA (both at final concentrations of 50 $\mu g \cdot ml^{-1}$). Each sample were analysed three times on three consecutive days to rule out diurnal fluctuation. If the deviation among all particular measurements of the same individual exceeded the threshold of 3%, additional analyses were conducted [78].

To assess heteroploid hybridization, seeds from the mixed population (i.e. population UP0466) were also analysed. Achenes were removed from the pericarp and chopped in the single-phase seeds buffer LBO1 (15M Tris, 2M Na_2 EDTA, 0.5M spermine tetrahydrochloride, 80M KCl, 20M NaCl, 0.1% Triton X-100, stored at −20°C [80]) together with the fluorochrome 4',6-diamidino-2-phenylindole (DAPI) and ß-mercapto-ethanol.

All samples were incubated for 5–10 minutes at room temperature before being run through each of two flow cytometers (relative genome size: CyFlow ML equipped with a 365-nm UV LED as the light source; absolute genome size: CyFlow SL with a diode-pumped 532-nm solid-state green laser; both Partec GmbH, Münster, Germany). The resulting histograms were evaluated in Partec FloMax 2.3 software (Partec GmbH, Münster, Germany). Only analyses providing peaks with a coefficient of variation of less than 3% for fresh and 5% for silica-dried material were processed further.

One-way analysis of variance (ANOVA), followed by Tukey's honest significant difference (HDS) test, was used to test the significance of genome size differences between the taxa analysed. Values of genome size were log-transformed before the analysis. All statistical analyses were performed and all plots were produced in the R statistical environment [81].

Chromosome counts. Chromosome counts were determined from root tips of germinating seeds and cultivated individuals. Selected samples were processed according to the modified protocol of Mandáková & Lysak [82].

Fresh roots (~1 cm long) were put into 1.5-ml Eppendorf tubes with distilled water and placed into a container with ice-flakes for 24 hours. Afterwards they were put into a freshly prepared fixative (ethanol: acetic acid, 3: 1, v: v) and stored overnight in a refrigerator (~4˚C). The material was stored at −20˚C in the fixative until further use.

The root tips were washed twice in distilled water (each time for 5 min), then a citrate buffer was applied and roots were washed in an orbital shaker (twice for 5 min). Subsequently, the buffer was sucked out of the sample and a 0.3% mixture of pectolytic enzymes (pectolyase, cellulase, cytohelicase) was added, followed by incubation in an incubator (37˚C, 120 min). Then the enzyme mixture was replaced with the same citrate buffer.

The white tip of the root meristem was cut under a stereomicroscope, excess buffer was removed, and the sample was sprinkled with 60% acetic acid with an incubation time of 1–2 min. The root meristem was disintegrated using dissecting needles and the obtained meristematic suspension was covered by a cover-slip. The slide was moved 2–3 times above a flame and then the material was carefully squashed.

The slides were placed into a freezer (~−80˚C) and after 10 minutes in the freezer the cover-slips were separated from the slides by razor. The samples were subsequently dyed with 15 μl of Vectashield with 4',6-diamidino-2-phenylindole (DAPI). The preparations were covered with new cover-slips and fixed with nail polish.

Chromosomes were observed under a Nikon Eclipse E600 microscope equipped with a Nikon DS-Qi1Mc camera, and images were acquired using NIS-Elements AR software.

Ecological relations. We used exactly recorded locations of all populations to get a basic grasp of the ecological preferences of major cytotypes (the diploid and tetraploid cytotypes of *U. dioica*). To evaluate the ecological relations of major cytotypes, we applied simple modelling using the Bioclim algorithm according to Chumová et al. [83]. In the first step, georeferenced data were spatially stratified to avoid discrepancies caused by unequal sampling (R package 'spThin', Aiello-Lemmens et al. [84]; a 20-km and 5-km threshold distance for tetraploid and diploid population, respectively, was used). The resulting 576 localities were used for the extraction of bioclimatic data. Data from raster layers for all 19 bioclimatic variables were extracted using the ‘extract’ function in the ‘raster’ R package [85]. Principal trends in the variation of bioclimatic variables were detected by PCA. Mutually uncorrelated variables were identified by stepwise forward selection and subjected to linear discriminant analysis. All analyses were conducted using the ‘MorphoTools’ R package for multivariate data handling [86].

In addition, correlations of relative fluorescence intensity value with elevation (dataset divided into two elevation ranges: 0–500 and >500 m above sea level), latitude and longitude were quantified by fitting a linear or quadratic function. To assess the affinity of both cytotypes to human-affected habitats, we adopted a four-level scale of synanthropy (sensu Tüxen 1956 [87]), which was arbitrarily assigned to each sampling locality. Subsequently, Pearson’s chisquare test [88] was used to determine the dependence between the degree of synanthropy and ploidy level.

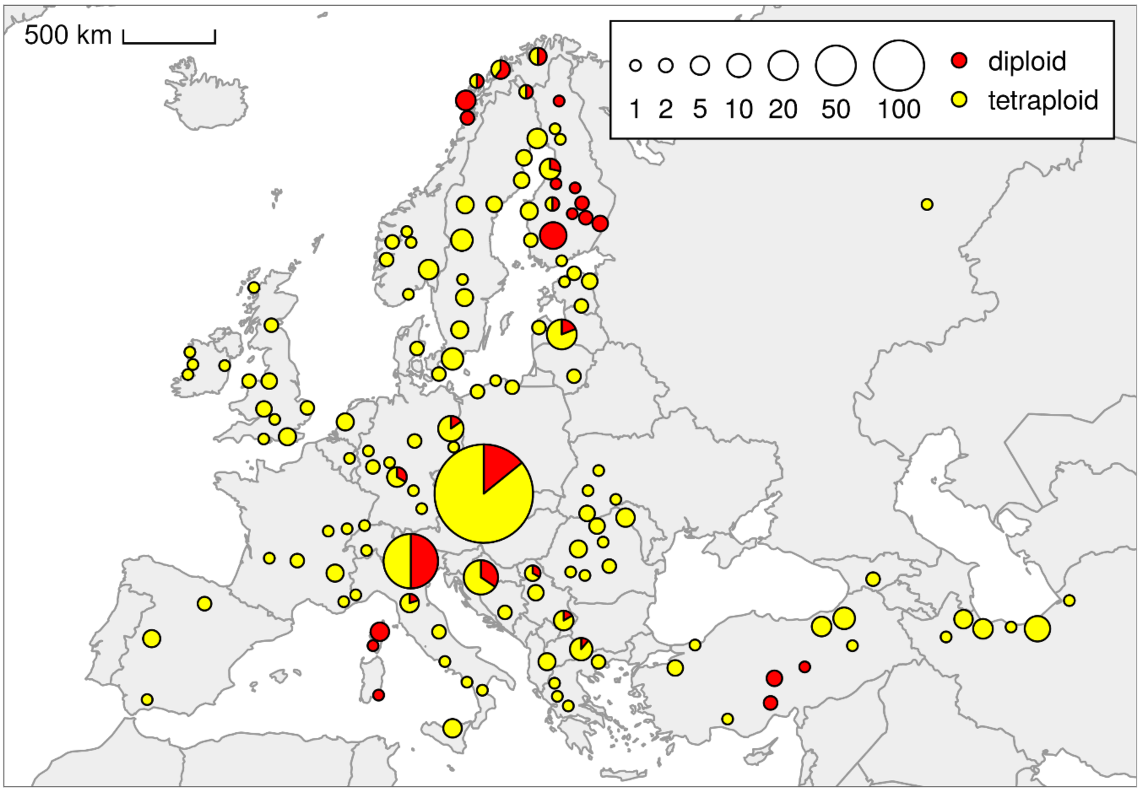

Fig 1. Distribution of two dominant cytotypes of *Urtica dioica* in Europe and West Asia. Map of all samples based on flow cytometric analyses of 1305 populations. The size of the circles reflects the number of populations.

Table 1. **Summary of absolute genome size of *Urtica dioica* and closely related species (2C-values in pg) and detected numbers of (somatic) chromosomes.**

Taxon	No. Of individuals analysed/No. of populations	Mean Cx-value (pg) ± SD*	2C-value range (pg)	Chrom. number (2n)	Difference compared to 2x (%)	Difference compared to 4x (%)
U. d. subsp. *dioica*	32/27	0.55 ± 0.04^{E}	2.08-2.20	52	–	–
U. d. subsp. *dioica* – 3x	1/1	0.54	–	39	–	–
U. d. subsp. *kurdistanica*	6/3	0.59 ± 0.01^{C}	1.15-1.20	-	–	–
U. d. subsp. *pubescens*	16/14	0.58 ± 0.03^{C}	1.10-1.21	26	–	–
U. d. subsp. *sondenii*	4/2	0.57 ± 0.01^{CD}	1.12-1.15	26	–	–
U. d. subsp. *subinermis*	19/13	0.58 ± 0.03^{C}	1.10-1.25	26	–	–
Closely related species:						
U. bianorii	1/1	0.83^{A}	–	–	43.5	24.3
U. d. subsp. *cypria*	6/1	0.55 ± 0.005^{DE}	1.65-1.67	–	44.4	23.9
U. kioviensis	5/4	0.71 ± 0.025^{B}	1.36-1.43	–	22.6	35.3
U. simensis	1/1	0.74^{B}	–	–	28.7	32.1

* Different letters indicate groups of taxa that are significantly different in Tukey HSD test.

Results

Flow cytometry

We determined the relative genome size of 6836 plants from 1295 populations (176 individuals were excluded due to poor-quality flow-cytometric histograms). Our results confirm the occurrence of two dominant DNA ploidy levels having the following mean relative fluorescence intensity values (± SD): 2x = 0.30 ± 0.01 (range: 0.24–0.36, 50% variation, n = 849), 4x = 0.57 ± 0.01 (range: 0.54–0.64, 18.5% variation, n = 5975). The average coefficient of variance (CV) was 1.68% (particular CVs are given in S1 Table). The tetraploid cytotype strongly prevailed over the diploid one (2x = 13%, 4x = 87%). Diploids were found frequently in mixed populations with prevailing tetraploids. For the first time we managed to detect a few triploid (8) and pentaploid (4) individuals in a mixed-ploidy population of diploids and tetraploids (3x = 0.44 ± 0.01 (range: 0.42–0.46, 9.5% variation, n = 8), 5x = 0.73 ± 0.02 (range: 0.71–0.77, 8.5% variation, n = 4); Fig 2, S3 and S4 Figs).

To assess the potential for heteroploid hybridization, we analysed 70 achenes from the mixed population (i.e. population UP0466; S1 Table). From diploid maternal plants (33 seeds overall), 82% of the progeny (27 achenes) was diploid (with 3x endosperm) and 18% (6) triploid (4x endosperm). Tetraploid maternal individuals (37 seeds overall) produced 94% (35 achenes) of tetraploid seeds (with 6x endosperm) and one triploid (5x endosperm) and one pentaploid seed (9x endosperm, S5 Fig).

To calibrate the measurements and detect differences between particular diploid subspecies, we also estimated absolute genome size for a reduced set of accessions (78 plants from 60 populations – *U. dioica*; 17 plants from 10 populations – closely related species; S2 Table, S6 Fig). Core diploid subspecies (*U. d.* subsp. *kurdistanica*, subsp. *pubescens*, subsp. *sondenii* and subsp. *subinermis*) did not differ from each other in absolute genome size whereas the other closely related species (i.e. species closely related to *U. dioica* crown clade in recent phylogenies) *U. bianorii*, *U. d.* subsp. *cypria*, *U. kioviensis* and *U. simensis* had significantly greater DNA content. Only *U. atrovirens*, which is also ranked among the closely related species of *U. dioica*, was assigned to the group of core diploid subspecies. We, for the first time, estimated the absolute genome size of *U. d.* subsp. *kurdistanica*, *U. d.* subsp. *cypria* and the triploid cytotype of *U. dioica* (a plant morphologically identical with *U. d.* subsp. *dioica*). Absolute genome size was determined for all the mentioned species and subjected to ANOVA and Tukey's HDS test ($p < 0.001$; Fig 3, Table 1, S7 Fig).

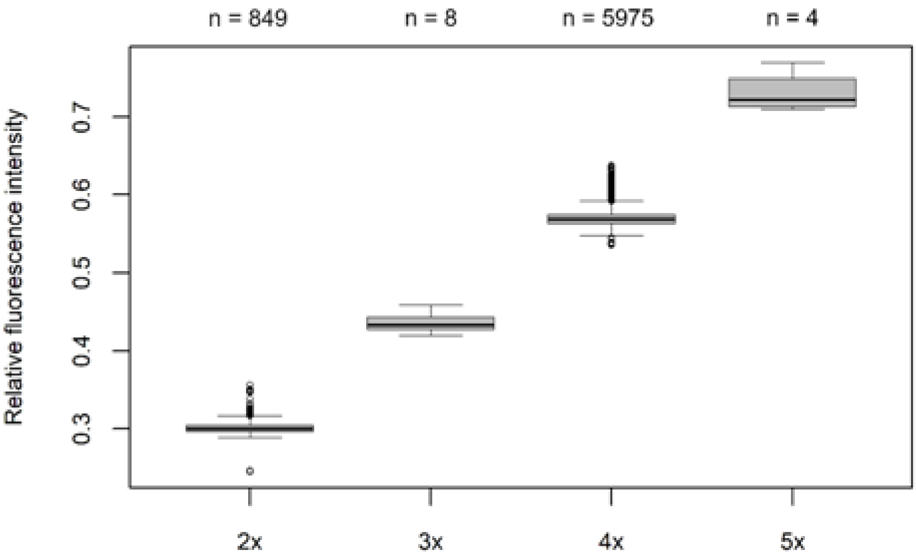

Fig 2. Box-and-whisker plot of relative fluorescence intensity of *Urtica dioica*. The numbers above the boxes indicate the numbers of individuals analysed.

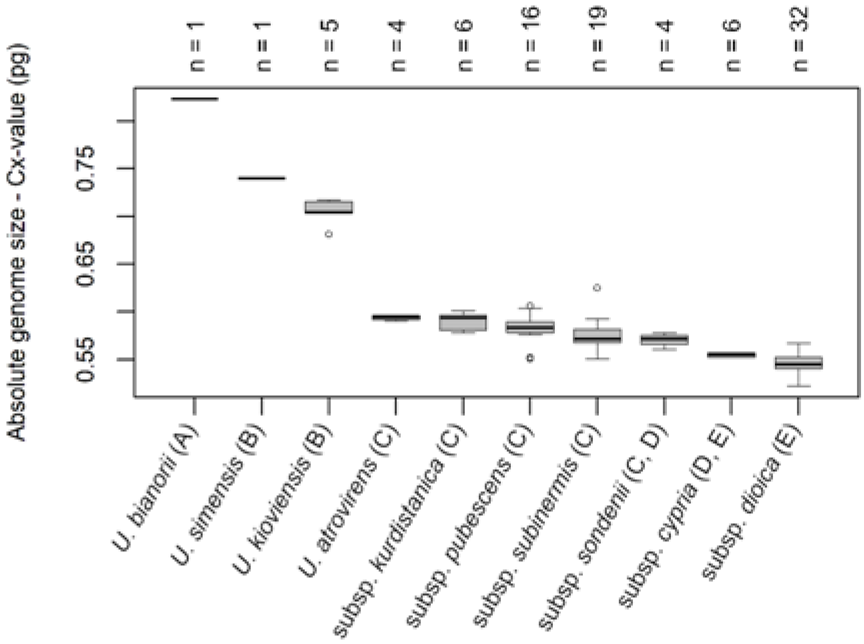

Fig. 3. Box-and-whisker plot of absolute genome size of *Urtica dioica* and closely related species. Absolute genome size of the 4x cytotype (*U. d.* subsp. *dioica*), the 2x cytotype (*U. d.* subsp. *kurdistanica*, subsp. *pubescens*, subsp. *sondenii*, subsp. *subinermis*) and closely related species (*U. atrovirens*, *U. bianorii*, *U. d.* subsp. *cypria*, *U. kioviensis* and *U. simensis*). The letters A–E show the grouping based on a one-way analysis of variance (ANOVA) followed by Tukey's test (HDS). The numbers above the boxes indicate the numbers of individuals analysed.

Chromosome counts

All DNA ploidy levels were verified by subsequent chromosome counts. Ten plants were checked for their chromosome numbers using fluorescent karyology. The chromosome number of 2n = 26 was ascertained for diploids (three plants classified as *U. d.* subsp. *pubescens*, subsp. *sondenii* and subsp. *subinermis*, respectively), 2n = 39 was ascertained for triploids (one plant morphologically identical with *U. d.* subsp. *dioica*), 2n = 52 was ascertained for tetraploids (five plants assigned to *U. d.* subsp. *dioica*) and 2n = 65 was ascertained for pentaploids (one plant also morphologically identical with *U. d.* subsp. *dioica*; Fig 4, Table 1).

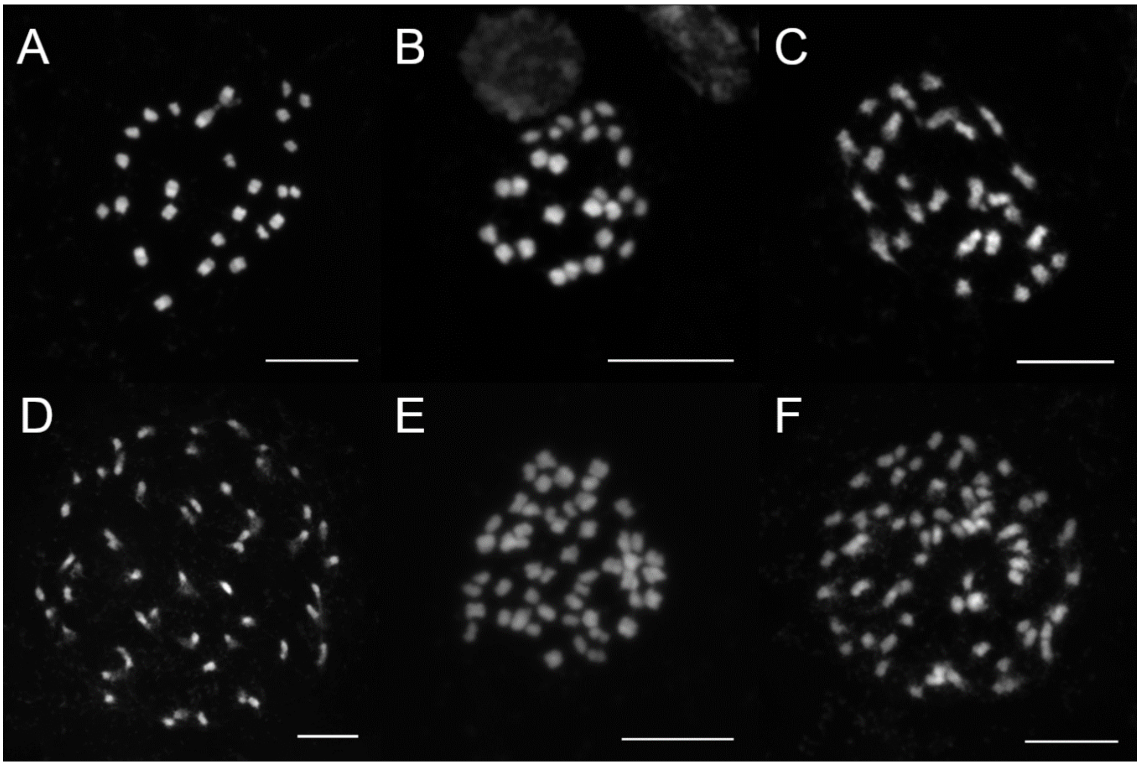

Fig 4. Microphotographs of somatic metaphases of *Urtica dioica*.(A) *U. d.* subsp. *pubescens* (population UP0009, Italy) − 2n = 2x = 26; (B) *U. d.* subsp. *sondenii* (population UP0584, Finland) − 2n = 2x = 26; (C) *U. d.* subsp. *subinermis* (population UP0059, Czech Republic) − 2n = 2x = 26; (D) *U. d.* subsp. *dioica* (population UP0033, France) − 2n = 4x = 52; (E) *U. d.* subsp. *dioica* (population UP0718, Iran) − 2n = 4x = 52; (F) Pentaploid cytotype of *U. dioica* (population UP0770, Czech Republic) − 2n = 5x = 65 (morphologically identical with *U. d.* subsp. *dioica*).

Ecological relations

Bioclimatic and geographic pattern. To verify the habitat and ecological preferences of individual ploidy levels, we used basic modelling. Our analysis of bioclimatic data in relation to the ploidy levels of individual populations and their exactly recorded positions shows that the variability of individual ploidy levels is interdependent. This is also confirmed by field observations, as in most cases diploid individuals grow in mixed populations with the tetraploid cytotype, which evinces a high degree of plasticity (e.g. ecological or morphological) shared with diploid individuals. In the stepwise selection analysis, the following features were the most contributing to group separation: BIO3 (Isothermality = BIO2/BIO7 * 100; this quantifies how much day-to-night temperatures oscillate relative to the summer-to- winter (annual) oscillations), BIO5 (Max Temperature of Warmest Month) and BIO17 (Precipitation of Driest Quarter; Fig 5).

We found a positive correlation between relative fluorescence intensity and longitude (cor = 0.161, $p < 0.001$); Fig 6A) and latitude (cor = 0.133, $p < 0.001$; Fig 6B) in the complete dataset of European populations. In the reduced dataset of diploid accessions (the complete dataset of diploids excluding *U. d.* subsp. *kurdistanica*), we detected a positive correlation between relative fluorescence intensity and longitude (cor = 0.296, $p < 0.001$). Diploid taxa growing in relict habitats preferred lower elevations compared to the ubiquitous tetraploid cytotype. Correlations of relative fluorescence intensity with elevation were significant for each of the datasets fitted with a linear function (0–500 m above sea level: cor = −0.305, $p < 0.001$; >500: cor = 0.344, $p < 0.001$) and in all data fitted with a quadratic function (cor = 0.208, $p < 0.001$; Fig 6C).

Affinity to synanthropic habitats. To determine habitat preferences, especially of relict diploids, we used the data from assessment of individual locations. Using Pearson's chisquared test, we have determined with a high degree of confidence that the probability of occurrence of a diploid population depends on the type of environment ($p < 0.001$). The distribution of diploid and tetraploid populations with respect to the environment is presented as in a contingency table (Table 2, Fig 7), along with associated standard residuals. The diploid cytotype of *U. dioica* (*U. d.* subsp. *kurdistanica*, subsp. *sondenii* and subsp. *subinermis*) tends to occur in less human-affected habitats (habitat type 3 and 4 on the four-level scale of synanthropy; Table 3). A special case is the diploid subspecies *U. d.* subsp. *pubescens* from the Po river basin, which occurs exclusively in highly synanthropic and strongly human-affected locations (habitat type 1 and 2 on the four-level scale of synanthropy; mode value for all diploid subspecies of *U. dioica*: 3; mode value for *U. d.* subsp. *pubescens*: 2). This stands in contrast to the tetraploid cytotype, which occurs in habitats of all types, although it prefers environments with an increased degree of synanthropy.

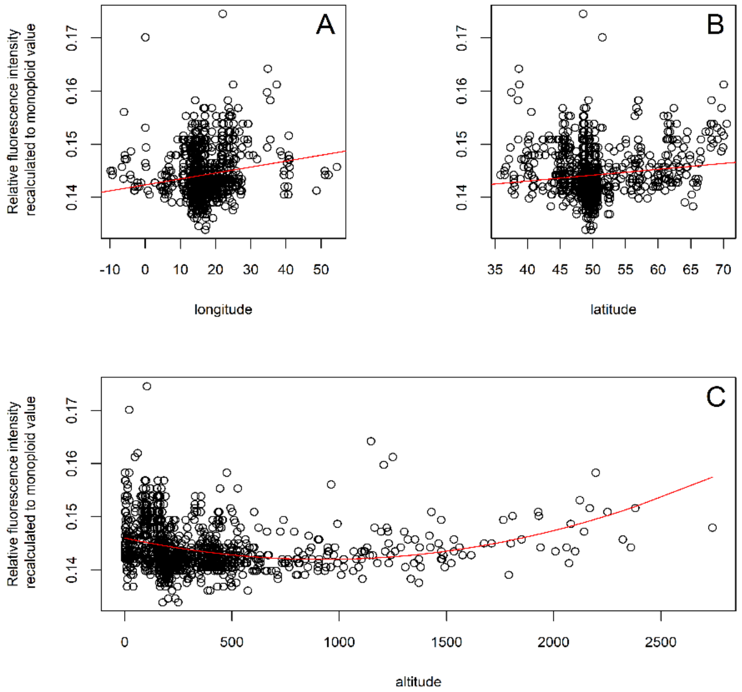

Fig 5. Discriminant analysis of two groups (DA) – Stepwise forward selection using basic modelling (Bioclim algorithm). Bioclimatic data related to the ploidy levels (diploid and tetraploid) of individual populations – stratified data. The features contributing the most to the variability were BIO3, 5 and 17; striped area – tetraploid cytotype, dotted area – diploid cytotype, grey area – overlapping of both cytotypes.

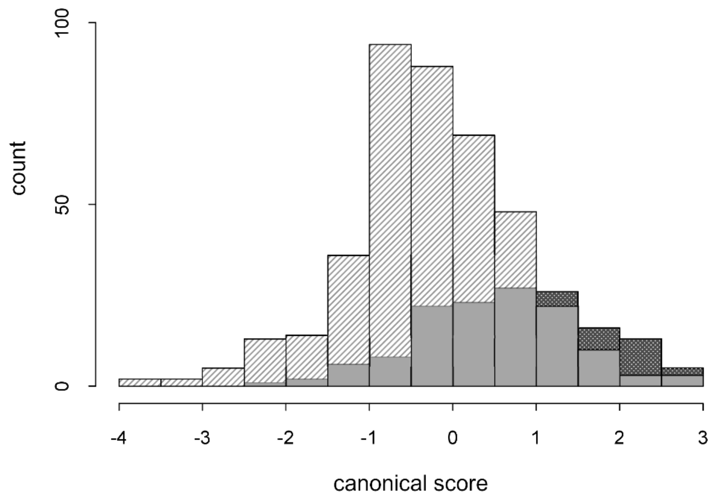

Fig 6. Relations between relative fluorescence intensity and longitude, latitude and elevation fitted with a linear or quadratic function. (A) Correlation of relative fluorescence intensity with longitude fitted with a linear function (complete dataset of European populations); (B) Correlation of relative fluorescence intensity with latitude fitted with a linear function (complete dataset of European populations); (C) Correlation of relative fluorescence intensity with elevation fitted with a quadratic function.

Table 2. Contingency table with standard residuals of diploid and tetraploid populations depending on habitat type.

Ploidy level	Environment type 1	Environment type 2	Environment type 3	Environment type 4
Diploids (2x)	1 (-3.90)	81 (-0.04)	182 (1.38)	4 (3.07)
Tetraploids (4x)	57 (3.90)	278 (0.04)	580 (-1.38)	1 (-3.07)

Table 3. Evaluation of the affinity of particular *Urtica dioica* cytotypes to human-affected habitats.

Level	Vegetation types and habitats	Degree of influence by man
1	intensively managed habitats (agricultural, ruderal, etc.), road margins, urbanized areas	highly nitrophilous and intensively human-affected locations
2	extensively cultivated landscapes, agricultural marginal habitats, cultivated and plantation-like forests	partly synanthropic and extensively cultivated locations
3	semi-natural vegetation, recent vegetation +/- corresponding to the potential natural vegetation *	semi-natural habitats
4	tundra marches, Mediterranean alpine zones, natural alluvial associations, other relict habitats	least human-affected habitats (~primary habitats)

* sensu Tüxen 1956 [87]

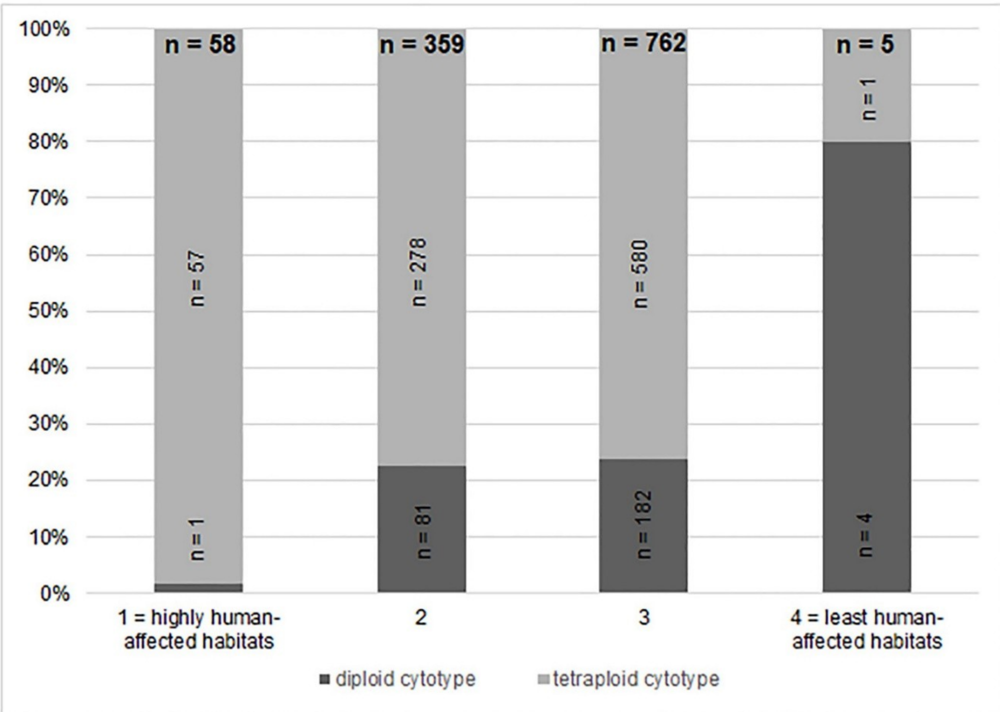

Fig 7. Ratio of individuals in habitats of different types – Four-level scale of synanthropy. Relative proportions of the two major cytotypes (diploid and tetraploid) captured in different types of human-affected habitats. For definitions and examples see Table 3. The numbers in columns indicate the number of populations depending on habitat type, corresponding to Table 2.

Discussion

During our large-scale screening of *Urtica dioica* across Europe and West Asia, we found two major ploidy levels: widely distributed tetraploids and less frequent diploids. We have not proved any strong correlation supporting either the generally suggested hypothesis that polyploids are more abundant at higher elevations and latitudes or the idea that diploids are confined to Southern European glacial refugia whereas polyploids occur across broader geographic ranges [89], often shifted to harsh environments. Instead, our results suggest that diploid plants show some degree of affinity to habitats less affected by human activities, in contrast to tetraploids, which tend to grow in human-made or strongly influenced habitats. Furthermore, our study has revealed a significant difference in absolute genome size between *U. dioica* and its closely related species *U. bianorii*, *U. dioica* subsp. *cypria*, *U. kioviensis* and *U. simensis* [72, 76, 90–95].

We are aware that the frequency of diploids detected would be significantly lower had we chosen an entirely random sampling strategy instead of partly preferentially targeting relict and natural habitats. Additional occurrences of the alluvial diploid cytotype (~*U. d*. subsp. *subinermis*) can be expected in Western Europe (especially in France and the United Kingdom). On the other hand, we sampled numerous relict habitats in Spain and northern Iran, and detected only tetraploids there, so the occurrence of a diploid cytotype is, in concordance with previously published chromosome counts [94, 96, 97], less probable in these two countries.

Major and minor cytotypes of *Urtica dioica*

The widely distributed tetraploids and the less frequent diploids possess the chromosome numbers of $2n = 2x = 26$ and $2n = 4x = 52$, respectively, ascertained here and also reported previously [61–63]. However, for the first time we managed to capture a small percentageof very rare triploid (8 individuals) and pentaploid (4 individuals) cytotypes, both in mixed-ploidy populations of diploids and tetraploids. The origin of these minor cytotypes is discussed below.

For some plants, we detected abnormal values of relative genome size (8 tetraploid individuals, range of 2C pg: 1.66–1.74), which could be explained by aneuploidy. The values might correspond to a loss of four chromosomes, i.e. to the frequently reported chromosome number $2n = 48$ [61–64, 98–102]. Unfortunately, we did not succeed in cultivating any of these aberrant individuals, so we cannot confirm any hypothetical aneuploid counts.

Data from our screening of seeds from both diploid and tetraploid maternal plants from a mixed-ploidy field population in southern Moravia (south-eastern Czech Republic – UP0466; S1 Table) suggest that gene flow between the two cytotypes can occur. Besides the ploidy level of the embryo, we also paid special attention to the ploidy of the endosperm in order to decipher the contribution of the paternal cytotype and thus to determine the seed formation pathway [80, 103]. The greater frequency of triploid embryos in seeds of diploid maternal plants might be in line with the greater frequency of tetraploid plants and thus the larger greater amount and pressure of diploid pollen grains (from tetraploid plants). Another explanation, not mutually exclusive with the previous, supposes that the spatial pattern of (often large) male and female clones of both cytotypes at the site may play a role. Although our data indicate the origin of triploid seeds via heteroploid crosses, we cannot fully exclude the ability of diploid plants to produce triploid seeds via unreduced gametes (i.e. reduced gamete fusion with a male unreduced gamete from diploid plants), in general, the formation of unreduced gametes is not frequent [104, 105]. The frequency of triploid seeds (18% from diploid and 3% from tetraploid maternal plants) also contradicts the frequency of adult triploid plants in mixed diploid- tetraploid populations (8 individuals). The most plausible explanation seems to be a triploid block (lower fitness of or strong selection against triploid seedlings, or lower germination rates of triploid seeds, or their inability to germinate, compared to diploid and tetraploid ones [106]). The detection of a pentaploid individual (with 9x endosperm) in the offspring of a tetraploid plant indicates the formation of an unreduced gamete at the 4x level and its fusion with a reduced (x) gamete from a diploid plant. Alternatively, pentaploids might originate from crosses between tetraploids and hexaploids, but we detected neither adult hexaploid plants nor pentaploids with the embryo: endosperm ploidy ratio indicating this hybridization history (5x embryo: 7x endosperm). A combination of a more extensive seed screen (incl. experimental hybridization) and molecular analyses should be carried out to assess the rate of gene flow. Nevertheless, we have confirmed the possibility of heteroploid hybridization, which might cause genetic erosion and therefore pose a threat to the far less abundant diploid populations.

Diploids as indicators of natural habitats versus synathrophic invasive tetraploids?

We detected geographically stratified elevational and ecological segregation. In Central Europe, the Balkans and the Baltic region, diploids are likely confined to lowland alluvial, especially white willow, gallery forests. In addition, river banks and the surroundings of water bodies, together with forest-tundra stands and ravine forests, are the predominating habitats of diploids in Northern Europe. By contrast, diploids in Anatolia tend to occupy natural habitats at higher elevations (e.g. screes). The species assembly of ancient Central European semi-natural alluvial forests was formed in the Early Holocene. Since the Neolithic period, the floodplains of lowland rivers experienced vast changes caused by erosion, soil deposition and eutrophication. The human-driven decline of woodlands, especially in the Medieval period, and changes in species composition led to the fragmentation of semi-natural woodlands, which are currently confined to more or less small patches within agricultural landscapes [107, 108]. The diploid cytotype of *U. dioica* is restricted to well preserved alluvial forests in Central and Western Europe, so diploids may also indicate relict habitats of this type. The rather narrow ecological niche of diploids compared to tetraploids might indicate, besides other phenomena, ploidy-related drought tolerance and greater plasticity in polyploids allowing tetraploid to occupy a broader spectrum of habitats [109–111]. Similar ecological diploid-polyploid differentiation has been described in the grass species *Deschampsia cespitosa* (L.) P. Beauv. (tussock grass) in Britain [112] and *Dactylis glomerata* L. (cock's-foot) in Spanish Galicia [22]. Diploids appeared to be restricted mainly to low-density forest-floor habitats in woodlands of mostly ancient, semi-natural origin whereas tetraploids were found in varied habitats, but they predominated in open places such as in meadows, pastures, plantations, their verges and waste grounds. Based on our observations, both cytotypes are ecologically differentiated, but tetraploids do not exhibit local adaptation. Instead, they have greater fitness across both diploid- and polyploid-occupied regions.

In contrast to diploids in Central Europe, Anatolian diploids occur at higher elevations compared to tetraploids and also in different habitats. Instead of European lowland and ravine forest they mostly occur in mountain screes. Analogously to Europe, however, the vast majority of Anatolian populations (from various habitats, including screes) are formed by tetraploids. Surprisingly, even in Anatolia a single diploid was found in an alluvial population (Cappadocia – population UP0038; S1 Table).

In general, however, we have not confirmed the frequently made assumption that polyploids are more abundant at higher elevations and latitudes because of their potentially greater ecological tolerance and colonization ability [1, 17, 113–116]. However, considering only the invasiveness of polyploids, our results are well in agreement with general suggestions. The widespread tetraploid cytotype of *U. dioica* is also often supposed to be an allopolyploid or a group of allopolyploids with different evolutionary histories (e.g. [117]). Polyploidization and hybridization likely went hand in hand, resulting in rapid divergence of the neopolyploid. Tetraploids were possibly predisposed to spread into ranges thanks to their potential for subsequent adaptation due to greater genetic diversity, higher survival rates and better fitness ascribed to the heterosis effect, restoring sexual reproduction following hybridization [37]. A more or less stable occurrence of diploids in semi-natural habitats and tetraploids in mainly human-made habitats, together with a recent spread of tetraploids, has also been reported for *Centaurea stoebe* [32, 33, 118] and *Seseli libanotis* (L.) W.D.J.Koch [119]. Although a positive correlation between invasiveness and ploidy seems to be in conflict with a negative correlation between invasiveness and genome size [120], it is their interaction that underlies their actual effects on plant phenotypes and physiology, and, ultimately, on invasion success [36].

Taxonomic consequences

In the two most recent phylogenies [67, 68], the crown clade of *Urtica* (predominantly formed by *U. dioica*) consist of different additional related taxa, depending on the molecular markers used. Based on a concatenated tree (combining nuclear and plastid markers [68]), *U. dioica* in the strict sense, an exclusively Eurasian group including *U. dioica* (except for subsp. *cypria*), *U. kioviensis* from western Eurasia and *U. platyphylla* Wedd. from Northeastern Eurasia is a sister group to Mediterranean endemics (*U. atrovirens*, *U. bianorii*) and two African species (*U. massaica* Mildbr., *U. simensis*). Together these taxa form a well-supported cluster. Our genome size data partly support this concept. *Urtica bianorii* and *U. d.* subsp. *cypria* clearly fall outside of the *U. dioica* s.str. group in published phylogenies, which is in concordance with our genome size data. *Urtica kioviensis*, which could not be separated from *U. dioica* s.str. in previous phylogenies [68], could be reliably separated from the Eurasian *U. dioica* s.str. clade using genotyping-by-sequencing data [121], and this separation is well supported and justified by our genome size estimations. Only *U. atrovirens*, which is ranked close to *U. dioica* s.str., did not significantly differ from diploid subspecies of *U. dioica* even though it is distinctive morphologically [93, 94]. We have thus confirmed that genome size can significantly contribute to the delineation and detection of taxa, and that differences between genome size values may be indicative of genetic distance (see e.g. [103, 122, 123]).

In addition to other already discussed reasons to recognize several intraspecific taxa of *U. dioica* at the subspecies level (i.e. extreme morphologic forms and sexual morphs), polyploidy evidently shapes the structured pattern confining diploid cytotypes to relict habitats (e.g. alluvial forests, tundra marches or Mediterranean alpine zones). The diploid subspecies (subsp. *kurdistanica*, subsp. *pubescens*, subsp. *sondenii* and subsp. *subinermis*) are more or less morphologically, ecologically and geographically defined and capture a considerable part of the morphological diversity present in Western Eurasian *Urtica dioica*. However, any clear delineation of some of them is anything but straightforward and even molecular approaches have failed to resolve infraspecific relationships [67, 68]. Although published chromosome counts/ploidy levels are very scarce, ploidy is widely accepted as a trait in the delineation of *Urtica dioica* subsp. *dioica* (tetraploid) and the rest of the subspecies [56]. Here we generally confirm that the diploid level (with the chromosome number of $2n = 26$) is associated with plants morphologically assigned to *U. d.* subsp. *subinermis*, *U. d.* subsp. *sondenii*, *U. d.* subsp. *pubescens* and *U. d.* subsp. *kurdistanica*. We did not find any significant differences in genome size between the subspecies, so genome size cannot serve as a supportive character in the delineation of homoploid taxa as in some another plant groups [123–126].

One particular matter for debate is the delimitation and geographic distribution of *U. d.* subsp. *pubescens*. Geltman [127, 128] regards it as an endemic of wetland territories in the Volga delta and its surroundings and in the lower Dnieper region whereas in its wide circumscription the species occupies a geographic area spanning Southern and Eastern Europe, western Turkey [72], Georgia and Azerbaijan [121]. According to Weigend [71] it can be identified by its green-grey leaf colour, a distinctly hairy stem and leaves on both sides, and based on the ratio of the width to the length of the lamina. However, minor morphological differences between populations (unpublished data) and, in addition, genetic differences between European and West Asian populations [121] may indicate a mosaic-like structure and different evolutionary histories within subsp. *pubescens* in its broad circumscription. We carried out an extensive screening of ploidy levels in populations of ‘hairy’ nettles from the Po river basin (northern Italy), tentatively assigned to *U. d.* subsp. *pubescens*. Across the basin and in adjacent mountain valleys, we found mostly diploid plants, even though this area is surrounded by expanses dominated by tetraploids (even from the south, i.e. on the slopes of the Apennines). Worth mentioning are two aspects: First, this is the only large area in our study that is most likely occupied nearly exclusively by diploid plants (S1 Fig); otherwise, diploids occur as a rule in mixed-ploidy populations, accompanied by tetraploids. Second, the Po river diploids regularly occur both in a wide range of highly synanthropic types of habitats and in semi-natural alluvial vegetation. Diploid populations might have survived the last glaciation in an refugium extending along the lower elevations of the southern Alps and in adjoining areas, as demonstrated for many alpine plants as well as for beech (*Fagus*) and some insect species [129–132]. Alternatively, diploids might have survived in more southerly located refuges in the Apennine Peninsula [133, 134]. In any case, the Po river diploids definitely deserve a further biosystematic/taxonomic evaluation.

The genome size of *U. d.* subsp. *kurdistanica* corresponds to 2n = 26 (diploid level) – the same as in the other diploid subspecies. However, chromosome counts are not available for this subspecies, so certain deviations from this number cannot be fully excluded. Nevertheless, ours is the first DNA ploidy level estimation for this subspecies. Both localities visited over the course of our study (Mt. Erciyes Dâgi (Argaeus) in Cappadocia the Gusguta valley in the Bolkar Dağlari Mts. in southern Anatolia) are also mentioned by Weigend [72], which confirms the taxonomical identity of the plants under study. They occur on high-mountain screes that are only marginally influenced by human activities (pastures) and therefore fall within the broad concept that diploids tend to inhabit natural or semi-natural habitats. Long-term survival of these diploid populations seems to be a plausible explanation at least for two reasons: In Anatolia there was no major Pleistocene ice-sheet similar to those covering the European Alps or Scandinavia and only mountain peaks exceeding the height of ca 2200 m were glaciated [135, 136]. Furthermore, higher elevations provided moist conditions contrasting with the drier climate that prevailed in lower elevations of Anatolia during glacial periods [137].

We did not find diploids among a total of 80 plants from Iran. Weigend [72] reported two subspecies of *U. dioica* from this country, namely subsp. *dioica* and subsp. *kurdistanica*. Our plants can be more or less identified as subsp. *dioica*, and their ploidy is thus in line with the general picture of diploid subsp. *kurdistanica* and tetraploid subsp. *dioica*. Still, several populations (north of Tehran – Mt. Damavand and its surroundings) formed a unique monoecious population and their inflorescences consisted of equal numbers of male and female flowers (male in the upper part of the inflorescence), which does not correspond to the morphological description of either subsp. *dioica* or subsp. *kurdistanica*.

Finally, despite our extensive screening, we failed to find diploid plants at several localities of the morphologically defined taxon *U. d.* subsp. *subinermis*. This subspecies therefore has to be considered only supposedly diploid, as no chromosome counts are presented in the respective papers. This applies, for example, to the Neusiedler See lake (northeastern Austria), where precisely defined localities of plants morphologically assigned to *U. d*. subsp. *subinermis* are mentioned by Geltman [127] and Weigend [71]. Tetraploid plants found over the course of our study (5975 plants sampled) morphologically resemble *U. d*. subsp. *subinermis*, which raises the question as to whether (auto)polyploidization has taken place in this subspecies, which would make the pattern of genomic evolution within the diploid-tetraploid complex of *Urtica dioica* considerably more complicated.

Conclusion

Our large-scale cytogeographic screening of *Urtica dioica* has revealed a complex pattern across a major part of the species' distribution range, consisting of a widespread tetraploid cytotype, low-abundant scattered diploids and sporadically occurring triploid and pentaploid plants. We have not found any differences in genome size (Cx-values) between most subspecies of *U. dioica* (*U. d*. subsp. *dioica*, subsp. *kurdistanica*, subsp. *pubescens*, subsp. *sondenii* and subsp. *subinermis*). On the other hand, *U. d*. subsp. *cypria* does differ in genome size from the rest of *U. dioica*. Moreover, Cx-values of closely related species (*U. bianorii*, *U. kioviensis* and *U. simensis*) clearly differ from those of *U. dioica*, and genome size can thus serve as a valuable supportive character in the delimitation of *U. dioica*. We have also found positive correlations between genome size and longitude and latitude in our complete dataset of European populations and a positive correlation of genome size with longitude in a reduced dataset of diploid accessions (the complete dataset of diploids excluding *U. d*. subsp. *kurdistanica*). Diploid taxa growing in relict habitats are more frequent at lower elevations. In addition, our study has revealed a significant affinity of diploids to less human-influenced semi-natural habitats (this does not apply diploids from the Po river basin, assigned to *U. d*. subsp. *pubescens*) and (in the European range) to lower elevations. The tetraploid cytotype, by contrast, tends to thrive even in highly synanthropic sites and is able to expand to higher elevations.

Supporting Information

S1 Table. List of analyses of *Urtica dioica* (sorted by population identification number). For each population, the following information is provided: geographic coordinates in the WGS-84 system, elevation, country abbreviation, collector's initials, number of analysed plants in simultaneous analyses, relative fluorescence intensity, DNA-ploidy level, and coefficient of variance of the standard and sample peaks. (PDF)

S2 Table. List of analyses (absolute genome size) of *Urtica dioica* (sorted by taxon and population identification number). For each population, the following information is provide: geographic coordinates in the WGS-84 system, elevation, country abbreviation, collector's initials, absolute genome size – 2C-value (pg), ploidy level, and coefficient of variance of standard and sample peaks. (PDF)

S1 Fig. Map of locations of *Urtica dioica* samples collected in the Po river basin (northern Italy). The size of the circles reflects the number of populations. The blue line indicates the outline of the Po river basin. (TIF)

S2 Fig. Map of locations of *Urtica dioica* samples collected in the Czech Republic and Slovakia. The size of the circles reflects the number of populations. (TIF)

S3 Fig. Relative fluorescence intensity variation in *Urtica dioica*. Two dominant ploidy levels were detected (red – 2x and yellow – 4x). (TIF)

S4 Fig. Flow cytometric histogram of all detected cytotypes of *Urtica dioica*. Simultaneous analysis – from the left: 2x – diploid cytotype, 3x – triploid, 4x – tetraploid, 5x – pentaploid, *Bellis perennis* – the internal standard. (TIF)

S5 Fig. Proportions of cytotypes of *Urtica dioica* seeds. (A) Ratio of diploid and triploid seeds from a 2x maternal plant (from the mixed-ploidy population); (B) Ratio of triploid, tetraploid and pentaploid seeds from a 4x maternal plant (from a mixed-ploidy population). (TIF)

S6 Fig. Map of locations of closely related species. Species closely related to the *U. dioica* clade in recent phylogenies, namely: *U. atrovirens*, *U. bianorii*, *U. kioviensis*. The top-left section shows the one population of *U. simensis* in Ethiopia. The size of the circles reflects the number of populations. For more details see S2 Table. (TIF)

S7 Fig. Absolute genome size variation in *Urtica dioica* and closely related species. Diploid cytotype – *U. d.* subsp. *kurdistanica*, subsp. *pubescens*, subsp. *sondenii* and subsp. *subinermis*; tetraploid cytotype – *U. d.* subsp. *dioica*; closely related species – *U. atrovirens*, *U. bianorii*, *U. d.* subsp. *cypria*, *U. kioviensis* and *U. simensis*). Numbers of analysed individuals are presented in parentheses. (TIF)

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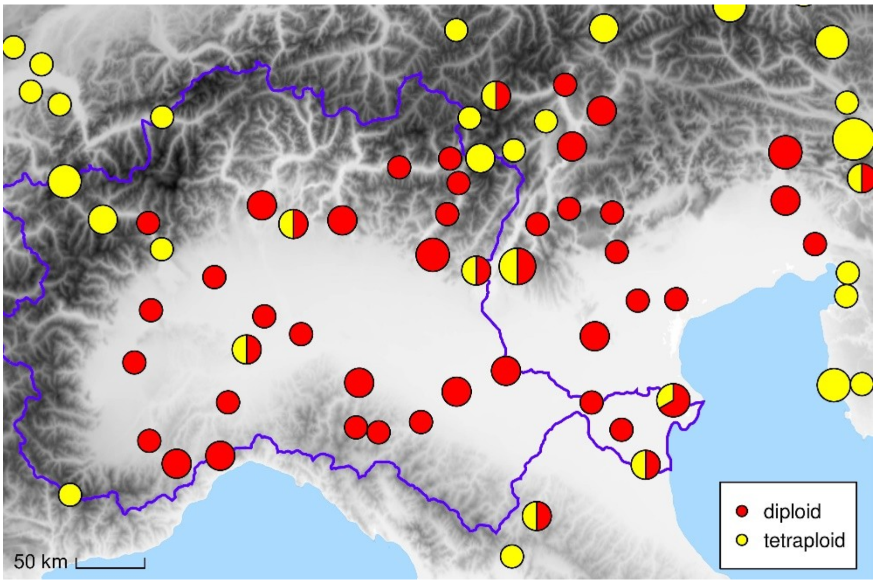
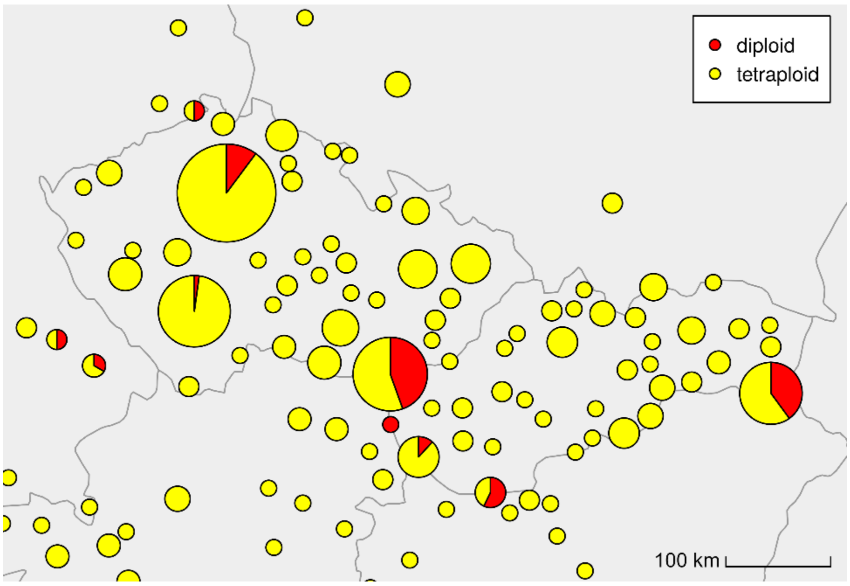
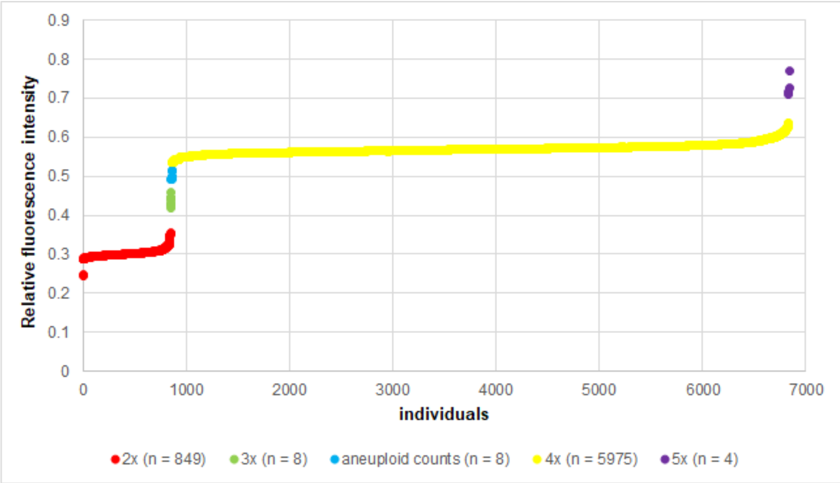
Supporting Figures



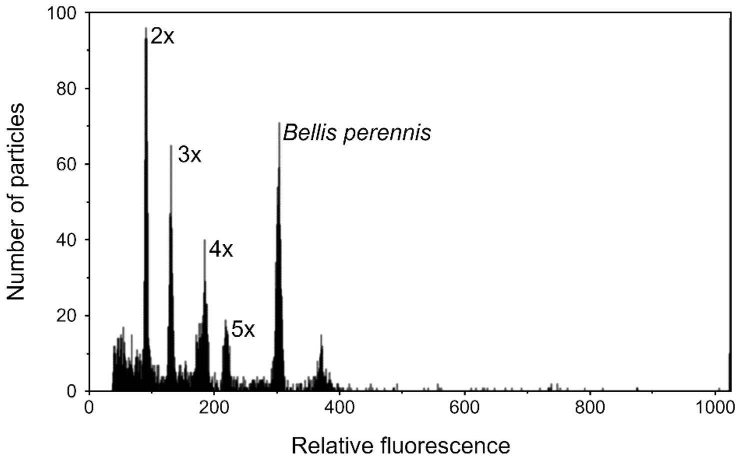
S1 Fig. Map of locations of *Urtica dioica* samples collected in the Po river basin (northern Italy). The size of the circles reflects the number of populations. The blue line indicates the outline of the Po river basin.



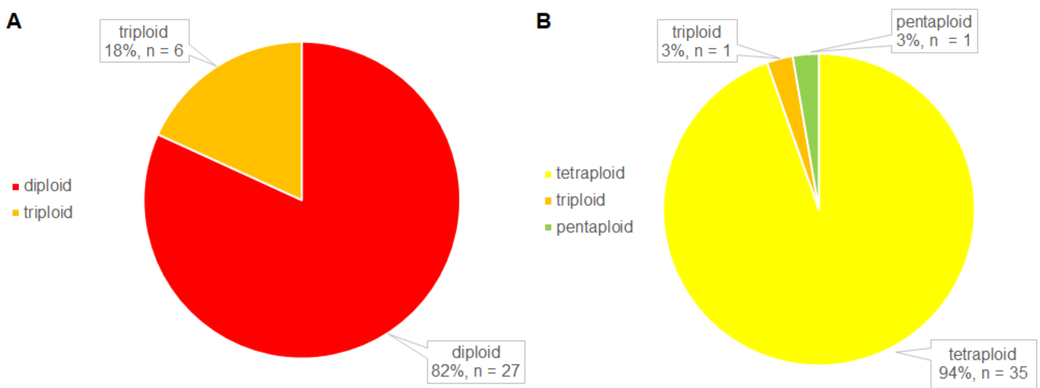
S2 Fig. Map of locations of *Urtica dioica* samples collected in the Czech Republic and Slovakia. The size of the circles reflects the number of populations.



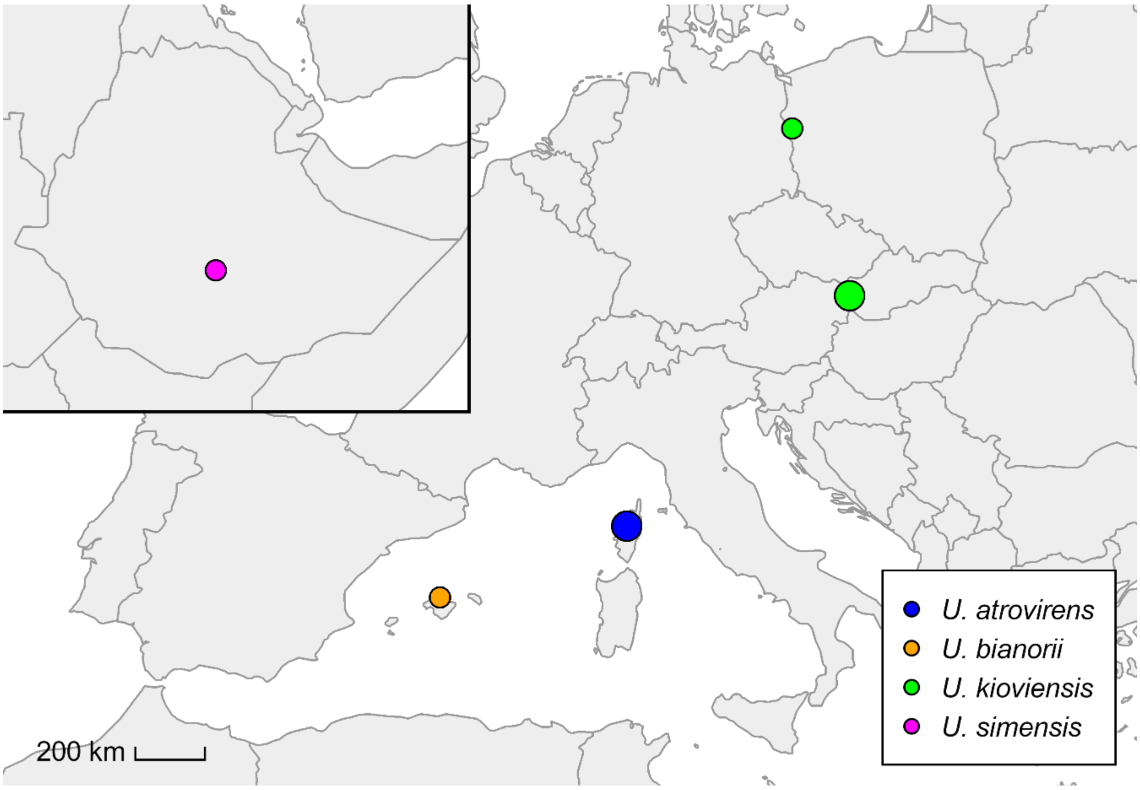
S3 Fig. Relative fluorescence intensity variation in *Urtica dioica*. Two dominant ploidy levels were detected (red – 2x and yellow – 4x).



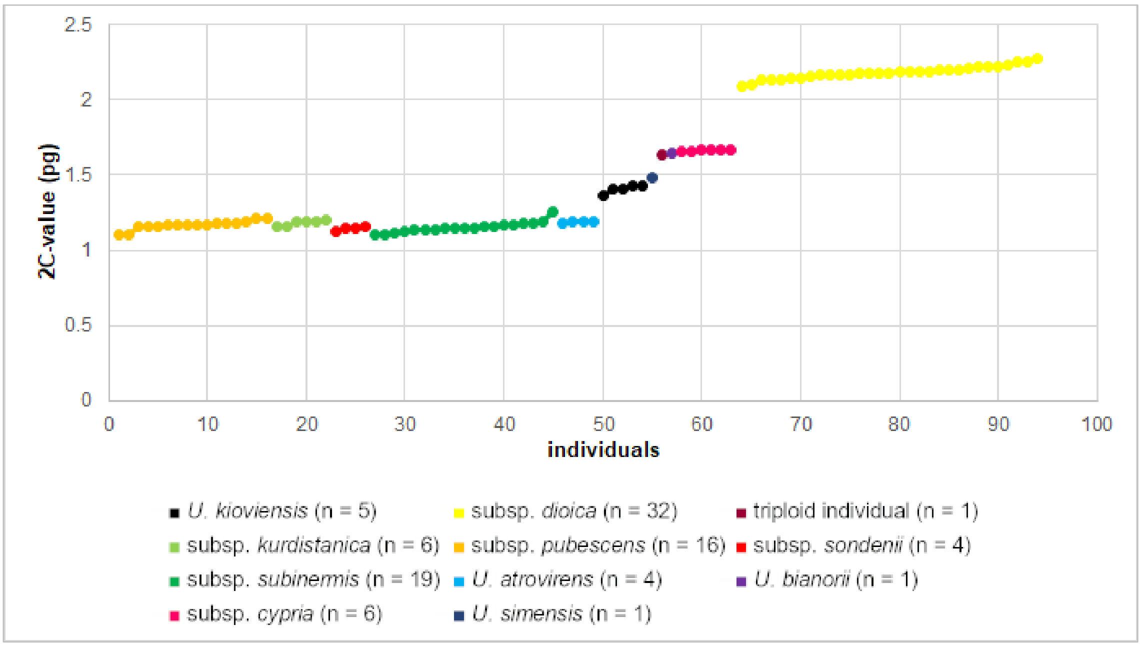
S4 Fig. Flow cytometric histogram of all detected cytotypes of *Urtica dioica*. Simultaneous analysis – from the left:2x – diploid cytotype, 3x – triploid, 4x – tetraploid, 5x – pentaploid, *Bellis perennis* – the internal standard.



S5 Fig. Proportions of cytotypes of *Urtica dioica* seeds. (A) Ratio of diploid and triploid seeds from a 2x maternal plant (from the mixed-ploidy population); (B) Ratio of triploid, tetraploid and pentaploid seeds from a 4x maternal plant (from a mixed-ploidy population).



S6 Fig. Map of locations of closely related species. Species closely related to the *U. dioica* clade in recent phylogenies, namely: *U. atrovirens*, *U. bianorii*, *U. kioviensis*. The top-left section shows the one population of *U. simensis* in Ethiopia. The size of the circles reflects the number of populations. For more details see S2 Table.



S7 Fig. Absolute genome size variation in *Urtica dioica* and closely related species. Diploid cytotype – *U. d.* subsp. *kurdistanica*, subsp. *pubescens*, subsp. *sondenii* and subsp. *subinermis*; tetraploid cytotype – *U. d.* subsp. *dioica*; closely related species – *U. atrovirens*, *U. bianorii*, *U. d.* subsp. *cypria*, *U. kioviensis* and *U. simensis*). Numbers of analysed individuals are presented in parentheses.

Supporting Tables

S1 Table. List of analyses of *Urtica dioica* (sorted by population identification number). For each population, the following information is provided: geographic coordinates in the WGS-84 system, elevation, country abbreviation, collector's initials, number of analysed plants in simultaneous analyses, relative fluorescence intensity, DNA-ploidy level, and coefficient of variance of the standard and sample peaks.

ID number of population	ID number of analysis	Taxon	Collector	Relative fluorescence intensity	DNA-ploidy level	CV of standard	CV of sample	N. of individuals in analysis	Latitude (WGS-84)	Longitude (WGS-84)	Altitude (m a.s.l.)	Country (ISO 3166-1)
UP0001	U0001	subsp. *dioica*	PT, TU	0,562	4	1,3	1,9	4	N48.55522	E11.58817	468	DEU
	U0002	subsp. *dioica*	PT, TU	0,562	4	1,3	1,9	4	N48.55522	E11.58817	468	DEU
UP0002	U0003	subsp. *dioica*	PT, TU	0,560	4	1,2	2,8	5	N47.83019	E11.90803	706	DEU
	U0004	subsp. *dioica*	PT, TU	0,560	4	1,2	2,8	5	N47.83019	E11.90803	706	DEU
UP0003	U0005	subsp. *dioica*	PT, TU	0,561	4	1,3	2,4	1	N47.45217	E11.86506	556	AUT
	U0006	subsp. *dioica*	PT, TU	0,569	4	1,2	1,9	1	N47.45217	E11.86506	556	AUT
	U0007	subsp. *dioica*	PT, TU	0,561	4	1,0	1,6	1	N47.45217	E11.86506	556	AUT
	U3305	subsp. *dioica*	PT, TU	0,573	4	1,1	1,6	1	N47.45217	E11.86506	556	AUT
	U3306	subsp. *dioica*	PT, TU	0,559	4	1,3	1,8	1	N47.45217	E11.86506	556	AUT
UP0004	U0008	subsp. *dioica*	PT, TU	0,557	4	1,3	1,8	3	N47.00861	E11.50800	1790	AUT
	U0009	subsp. *dioica*	PT, TU	0,557	4	1,3	1,8	3	N47.00861	E11.50800	1790	AUT
UP0005	U0010	subsp. *pubescens*	PT, TU	0,299	2	1,2	1,7	2	N46.57342	E11.52164	444	ITA
	U0011	subsp. *pubescens*	PT, TU	0,299	2	1,2	1,7	2	N46.57342	E11.52164	444	ITA
	U0012	subsp. *pubescens*	PT, TU	0,333	2	1,2	2,8	1	N46.57342	E11.52164	444	ITA
UP0006	U0013	subsp. *pubescens*	PT, TU	0,300	2	1,5	2,5	2	N46.56411	E11.51614	433	ITA
	U0014	subsp. *pubescens*	PT, TU	0,300	2	1,5	2,5	2	N46.56411	E11.51614	433	ITA
	U0015	subsp. *pubescens*	PT, TU	0,301	2	1,2	2,2	3	N46.56411	E11.51614	433	ITA
	U0016	subsp. *pubescens*	PT, TU	0,294	2	1,3	2,6	4	N46.56411	E11.51614	433	ITA
	U0017	subsp. *pubescens*	PT, TU	0,301	2	1,2	2,2	5	N46.56411	E11.51614	433	ITA
	U0018	subsp. *pubescens*	PT, TU	0,296	2	1,4	2,1	6	N46.56411	E11.51614	433	ITA
UP0007	U0019	subsp. *pubescens*	PT, TU	0,296	2	1,3	2,0	4	N46.37231	E11.27297	230	ITA
	U0020	subsp. *pubescens*	PT, TU	0,296	2	1,3	2,0	4	N46.37231	E11.27297	230	ITA
	U0021	subsp. *pubescens*	PT, TU	0,296	2	1,3	2,0	4	N46.37231	E11.27297	230	ITA
	U0022	subsp. *pubescens*	PT, TU	0,296	2	1,3	2,0	4	N46.37231	E11.27297	230	ITA
UP0008	U0023	subsp. *pubescens*	PT, TU	0,307	2	1,2	2,3	1	N46.34064	E11.28606	235	ITA
	U0024	subsp. *pubescens*	PT, TU	0,299	2	1,4	2,3	1	N46.34064	E11.28606	235	ITA
	U0025	subsp. *pubescens*	PT, TU	0,303	2	1,3	2,3	1	N46.34064	E11.28606	235	ITA
	U0026	subsp. *pubescens*	PT, TU	0,296	2	1,1	1,8	1	N46.34064	E11.28606	235	ITA
	U0027	subsp. *pubescens*	PT, TU	0,295	2	0,9	2,7	1	N46.34064	E11.28606	235	ITA
	U0028	subsp. *pubescens*	PT, TU	0,298	2	1,5	2,0	1	N46.34064	E11.28606	235	ITA
UP0009	U0029	subsp. *pubescens*	PT, TU	0,298	2	1,2	2,2	1	N45.69819	E10.92406	124	ITA
	U0030	subsp. *pubescens*	PT, TU	0,297	2	1,5	1,6	1	N45.69819	E10.92406	124	ITA
	U0031	subsp. *pubescens*	PT, TU	0,299	2	1,0	1,9	1	N45.69819	E10.92406	124	ITA
	U0032	subsp. *pubescens*	PT, TU	0,299	2	1,5	2,7	1	N45.69819	E10.92406	124	ITA

ID number of population	ID number of analysis	Taxon	Collector	Relative fluorescence intensity	DNA-ploidy level	CV of standard	CV of sample	N. of individuals in analysis	Latitude (WGS-84)	Longitude (WGS-84)	Altitude (m a.s.l.)	Country (ISO 3166-1)
UP0010	U0033	subsp. *dioica*	PT, TU	0,573	4	1,3	1,7	1	N45.64967	E10.93133	872	ITA
	U0034	subsp. *dioica*	PT, TU	0,566	4	1,2	1,9	1	N45.64967	E10.93133	872	ITA
	U0035	subsp. *dioica*	PT, TU	0,562	4	1,2	1,9	1	N45.64967	E10.93133	872	ITA
	U0036	subsp. *dioica*	PT, TU	0,570	4	1,6	1,8	1	N45.64967	E10.93133	872	ITA
	U0037	subsp. *dioica*	PT, TU	0,561	4	1,4	1,9	1	N45.64967	E10.93133	872	ITA
UP0011	U0038	subsp. *pubescens*	PT, TU	0,301	2	1,4	2,5	1	N45.28419	E11.54436	14	ITA
	U0039	subsp. *pubescens*	PT, TU	0,303	2	1,1	2,4	1	N45.28419	E11.54436	14	ITA
	U0040	subsp. *pubescens*	PT, TU	0,293	2	1,2	2,2	1	N45.28419	E11.54436	14	ITA
UP0012	U0041	subsp. *pubescens*	PT, TU	0,292	2	1,1	2,0	1	N45.29367	E11.62086	206	ITA
	U0042	subsp. *pubescens*	PT, TU	0,297	2	1,1	2,4	1	N45.29367	E11.62086	206	ITA
	U0043	subsp. *pubescens*	PT, TU	0,298	2	1,0	2,0	1	N45.29367	E11.62086	206	ITA
	U0044	subsp. *pubescens*	PT, TU	0,294	2	1,5	2,8	1	N45.29367	E11.62086	206	ITA
	U0045	subsp. *pubescens*	PT, TU	0,294	2	1,6	2,2	1	N45.29367	E11.62086	206	ITA
UP0013	U0046	subsp. *pubescens*	PT, TU	0,296	2	1,5	2,4	1	N44.91133	E11.59153	8	ITA
	U0047	subsp. *pubescens*	PT, TU	0,294	2	1,7	2,2	1	N44.91133	E11.59153	8	ITA
	U0048	subsp. *pubescens*	PT, TU	0,293	2	1,2	2,1	1	N44.91133	E11.59153	8	ITA
	U0049	subsp. *pubescens*	PT, TU	0,296	2	1,1	2,2	1	N44.91133	E11.59153	8	ITA
	U0050	subsp. *pubescens*	PT, TU	0,297	2	1,7	2,1	1	N44.91133	E11.59153	8	ITA
UP0014	U0051	subsp. *pubescens*	PT, TU	0,301	2	1,3	1,7	1	N44.76683	E11.85939	1	ITA
	U0052	subsp. *pubescens*	PT, TU	0,301	2	1,6	2,4	1	N44.76683	E11.85939	1	ITA
UP0015	U0053	subsp. *pubescens*	PT, TU	0,299	2	1,2	2,0	1	N44.60553	E12.09756	1	ITA
	U0054	subsp. *pubescens*	PT, TU	0,303	2	1,5	2,3	1	N44.60553	E12.09756	1	ITA
	U0055	subsp. *pubescens*	PT, TU	0,301	2	1,2	2,2	1	N44.60553	E12.09756	1	ITA
UP0016	U0056	subsp. *dioica*	PT, TU	0,588	4	1,3	1,8	1	N44.54508	E12.06253	2	ITA
	U0057	subsp. *dioica*	PT, TU	0,573	4	1,3	2,4	1	N44.54508	E12.06253	2	ITA
	U0058	subsp. *dioica*	PT, TU	0,579	4	0,9	1,6	1	N44.54508	E12.06253	2	ITA
UP0017	U0059	subsp. *pubescens*	PT, TU	0,295	2	1,5	2,2	1	N44.24497	E11.19314	346	ITA
	U0060	subsp. *dioica*	PT, TU	0,577	4	1,2	1,7	1	N44.24497	E11.19314	346	ITA
	U0061	subsp. *dioica*	PT, TU	0,577	4	1,4	1,4	1	N44.24497	E11.19314	346	ITA
UP0018	U0062	subsp. *dioica*	PT, TU	0,578	4	1,4	2,0	1	N44.00511	E11.00950	831	ITA
	U0063	subsp. *dioica*	PT, TU	0,563	4	1,5	1,7	1	N44.00511	E11.00950	831	ITA
UP0019	U0064	subsp. *pubescens*	PT, TU	0,292	2	1,3	2,6	1	N45.04953	E10.84967	20	ITA
	U0065	subsp. *pubescens*	PT, TU	0,295	2	1,3	2,2	1	N45.04953	E10.84967	20	ITA
	U0066	subsp. *pubescens*	PT, TU	0,293	2	1,3	2,0	1	N45.04953	E10.84967	20	ITA
	U0067	subsp. *pubescens*	PT, TU	0,292	2	1,2	2,1	1	N45.04953	E10.84967	20	ITA
	U0068	subsp. *pubescens*	PT, TU	0,295	2	1,1	2,1	1	N45.04953	E10.84967	20	ITA
UP0020	U0069	subsp. *pubescens*	PT, TU	0,301	2	1,3	2,0	1	N45.54856	E10.81933	101	ITA
	U0070	subsp. *pubescens*	PT, TU	0,305	2	1,5	2,6	1	N45.54856	E10.81933	101	ITA
	U0071	subsp. *pubescens*	PT, TU	0,300	2	1,2	2,0	1	N45.54856	E10.81933	101	ITA
	U0072	subsp. *pubescens*	PT, TU	0,298	2	1,4	2,0	1	N45.54856	E10.81933	101	ITA
	U3304	subsp. *pubescens*	PT, TU	0,301	2	1,3	2,7	1	N45.54856	E10.81933	101	ITA

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UP0021	U0073	subsp. *dioica*	PT, TU	0,556	4	1,4	1,4	5	N45.91701	E15.98376	886	HRV
UP0022	U0074	subsp. *dioica*	PT, TU	0,566	4	1,2	1,9	1	N47.06294	E11.47494	1349	AUT
	U0075	subsp. *dioica*	PT, TU	0,566	4	1,4	2,2	1	N47.06294	E11.47494	1349	AUT
	U0076	subsp. *dioica*	PT, TU	0,566	4	1,2	2,2	1	N47.06294	E11.47494	1349	AUT
UP0023	U0094	subsp. *dioica*	PT, TU	0,567	4	1,1	1,4	5	N45.90171	E15.94975	992	HRV
UP0024	U0095	subsp. *subinermis*	PT, TU	0,296	2	1,3	1,8	2	N44.88181	E15.89882	216	BIH
UP0025	U0096	subsp. *dioica*	PT, TU	0,566	4	1,3	1,6	4	N46.37277	E15.99590	198	SVN
UP0026	U0097	subsp. *dioica*	PT, TU	0,568	4	1,4	2,0	1	N48.12678	E16.60739	157	AUT
	U0098	subsp. *dioica*	PT, TU	0,572	4	1,7	2,8	1	N48.12678	E16.60739	157	AUT
	U0099	subsp. *dioica*	PT, TU	0,562	4	1,2	1,8	1	N48.12678	E16.60739	157	AUT
	U3197	subsp. *dioica*	PT, TU	0,568	4	1,3	1,9	1	N48.12678	E16.60739	157	AUT
UP0027	U0100	subsp. *dioica*	PT, TU	0,584	4	1,5	2,5	1	N47.86714	E16.83800	119	AUT
	U0101	subsp. *dioica*	PT, TU	0,561	4	1,5	1,8	1	N47.86714	E16.83800	119	AUT
	U0102	subsp. *dioica*	PT, TU	0,565	4	1,1	1,6	1	N47.86714	E16.83800	119	AUT
UP0028	U0103	subsp. *dioica*	PT, TU	0,560	4	1,9	1,8	1	N47.92331	E16.72031	115	AUT
	U0104	subsp. *dioica*	PT, TU	0,575	4	1,2	1,6	1	N47.92331	E16.72031	115	AUT
	U0105	subsp. *dioica*	PT, TU	0,565	4	1,3	1,8	1	N47.92331	E16.72031	115	AUT
	U0106	subsp. *dioica*	PT, TU	0,568	4	0,9	1,8	1	N47.92331	E16.72031	115	AUT
	U0107	subsp. *dioica*	PT, TU	0,563	4	1,2	1,7	1	N47.92331	E16.72031	115	AUT
UP0029	U0108	subsp. *dioica*	PT, TU	0,568	4	1,2	1,5	1	N48.33775	E16.06386	177	AUT
	U0109	subsp. *dioica*	PT, TU	0,571	4	1,2	1,6	1	N48.33775	E16.06386	177	AUT
	U0110	subsp. *dioica*	PT, TU	0,557	4	1,3	1,7	1	N48.33775	E16.06386	177	AUT
	U3199	subsp. *dioica*	PT, TU	0,564	4	1,2	1,7	1	N48.33775	E16.06386	177	AUT
UP0030	U0111	subsp. *dioica*	PT, ZC	0,571	4	1,1	1,8	1	N45.58577	E2.79005	973	FRA
	U0112	subsp. *dioica*	PT, ZC	0,571	4	1,1	1,8	1	N45.58577	E2.79005	973	FRA
	U0113	subsp. *dioica*	PT, ZC	0,571	4	1,1	1,8	1	N45.58577	E2.79005	973	FRA
UP0031	U0114	subsp. *dioica*	PT, ZC	0,561	4	1,3	1,9	1	N43.71287	E6.50527	901	FRA
	U0115	subsp. *dioica*	PT, ZC	0,561	4	1,3	1,9	1	N43.71287	E6.50527	901	FRA
	U0116	subsp. *dioica*	PT, ZC	0,561	4	1,3	1,9	1	N43.71287	E6.50527	901	FRA
UP0032	U0117	subsp. *dioica*	PT, ZC	0,569	4	1,5	2,3	1	N44.99695	E5.60290	1079	FRA
	U0118	subsp. *dioica*	PT, ZC	0,569	4	1,5	2,3	1	N44.99695	E5.60290	1079	FRA
	U0119	subsp. *dioica*	PT, ZC	0,569	4	1,5	2,3	1	N44.99695	E5.60290	1079	FRA
UP0033	U0120	subsp. *dioica*	PT, ZC	0,571	4	1,7	1,7	1	N46.36237	E6.51936	422	FRA
	U0121	subsp. *dioica*	PT, ZC	0,571	4	1,7	1,7	1	N46.36237	E6.51936	422	FRA
	U1262	subsp. *dioica*	PT, ZC	0,571	4	1,7	1,7	1	N46.36237	E6.51936	422	FRA
UP0034	U0122	subsp. *dioica*	PT, ZC	0,566	4	1,7	2,6	1	N46.59936	E6.31844	1615	CHE
	U0123	subsp. *dioica*	PT, ZC	0,566	4	1,7	2,6	1	N46.59936	E6.31844	1615	CHE
	U0124	subsp. *dioica*	PT, ZC	0,579	4	1,8	3,3	1	N46.59936	E6.31844	1615	CHE
UP0035	U0125	subsp. *dioica*	PT, ZC	0,595	4	1,8	2,1	1	N46.52395	E6.58139	370	CHE
	U0126	subsp. *dioica*	PT, ZC	0,595	4	1,8	2,1	1	N46.52395	E6.58139	370	CHE
	U0127	subsp. *dioica*	PT, ZC	0,577	4	1,6	3,2	1	N46.52395	E6.58139	370	CHE

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UP0036	U0135	subsp. *dioica*	TU	0,592	4	1,5	2,2	1	N39.82700	E16.31808	279	ITA
	U0517	subsp. *dioica*	TU	0,613	4	1,3	2,6	1	N39.82700	E16.31808	279	ITA
	U0532	subsp. *dioica*	TU	0,598	4	1,1	2,3	1	N39.82700	E16.31808	279	ITA
	U0533	subsp. *dioica*	TU	0,597	4	1,4	2,5	1	N39.82700	E16.31808	279	ITA
	U0534	subsp. *dioica*	TU	0,607	4	1,2	2,4	1	N39.82700	E16.31808	279	ITA
	U0535	subsp. *dioica*	TU	0,598	4	1,6	2,7	1	N39.82700	E16.31808	279	ITA
	U0536	subsp. *dioica*	TU	0,615	4	1,4	2,5	1	N39.82700	E16.31808	279	ITA
UP0037	U0139	subsp. *dioica*	TU	0,588	4	1,3	1,7	1	N37.13425	E31.80033	1227	TUR
	U0521	subsp. *dioica*	TU	0,587	4	0,8	1,6	1	N37.13425	E31.80033	1227	TUR
	U0522	subsp. *dioica*	TU	0,588	4	1,3	1,7	1	N37.13425	E31.80033	1227	TUR
	U0523	subsp. *dioica*	TU	0,597	4	0,9	1,8	1	N37.13425	E31.80033	1227	TUR
	U0547	subsp. *dioica*	TU	0,588	4	1,3	1,7	1	N37.13425	E31.80033	1227	TUR
	U0548	subsp. *dioica*	TU	0,588	4	1,3	1,7	1	N37.13425	E31.80033	1227	TUR
	U0549	subsp. *dioica*	TU	0,588	4	1,3	1,7	1	N37.13425	E31.80033	1227	TUR
	U3535	subsp. *dioica*	TU	0,588	4	1,3	1,7	1	N37.13425	E31.80033	1227	TUR
UP0038	U0140	subsp. *subinermis*	TU	0,329	2	1,7	3,1	1	N38.63836	E34.82100	1148	TUR
	U0524	subsp. *subinermis*	TU	0,324	2	1,0	3,2	1	N38.63836	E34.82100	1148	TUR
	U0525	subsp. *subinermis*	TU	0,356	2	2,6	4,5	1	N38.63836	E34.82100	1148	TUR
	U0526	subsp. *subinermis*	TU	0,322	2	0,9	2,9	1	N38.63836	E34.82100	1148	TUR
	U0527	subsp. *subinermis*	TU	0,319	2	0,9	2,9	1	N38.63836	E34.82100	1148	TUR
	U0528	subsp. *subinermis*	TU	0,318	2	1,2	3,5	1	N38.63836	E34.82100	1148	TUR
	U0530	subsp. *subinermis*	TU	0,338	2	1,2	3,7	1	N38.63836	E34.82100	1148	TUR
	U0550	subsp. *subinermis*	TU	0,333	2	0,8	3,6	1	N38.63836	E34.82100	1148	TUR
	U3536	subsp. *subinermis*	TU	0,323	2	1,0	2,6	1	N38.63836	E34.82100	1148	TUR
UP0039	U0142	subsp. *dioica*	TU	0,616	4	1,4	3,0	1	N40.11336	E29.07897	1430	TUR
	U0531	subsp. *dioica*	TU	0,594	4	1,0	2,0	1	N40.11336	E29.07897	1430	TUR
	U0562	subsp. *dioica*	TU	0,596	4	1,3	2,4	1	N40.11336	E29.07897	1430	TUR
	U0564	subsp. *dioica*	TU	0,604	4	0,9	3,3	1	N40.11336	E29.07897	1430	TUR
UP0040	U0143	subsp. *dioica*	TU	0,571	4	1,4	2,9	1	N41.03778	E30.68261	46	TUR
	U0143	subsp. *dioica*	TU	0,571	4	1,1	2,5	1	N41.03778	E30.68261	46	TUR
	U0144	subsp. *dioica*	TU	0,607	4	0,9	2,4	1	N41.03778	E30.68261	46	TUR
	U0144	subsp. *dioica*	TU	0,609	4	1,4	3,3	1	N41.03778	E30.68261	46	TUR
	U0145	subsp. *dioica*	TU	0,591	4	1,8	2,6	1	N41.03778	E30.68261	46	TUR
	U0145	subsp. *dioica*	TU	0,594	4	1,3	1,9	1	N41.03778	E30.68261	46	TUR
	U0565	subsp. *dioica*	TU	0,591	4	1,2	2,4	1	N41.03778	E30.68261	46	TUR
	U0566	subsp. *dioica*	TU	0,598	4	1,6	2,2	1	N41.03778	E30.68261	46	TUR
	U0567	subsp. *dioica*	TU	0,589	4	1,5	3,6	1	N41.03778	E30.68261	46	TUR
UP0041	U0146	subsp. *dioica*	PT	0,584	4	0,9	1,5	1	N50.13757	E15.99272	291	CZE
	U0147	subsp. *dioica*	PT	0,597	4	1,2	2,9	1	N50.13757	E15.99272	291	CZE
UP0042	U0148	subsp. *subinermis*	LR	0,305	2	0,8	3,0	1	N48.68281	E16.93925	153	CZE
UP0043	U0149	subsp. *dioica*	LR	0,573	4	1,1	1,5	1	N48.68231	E16.94206	160	CZE

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UP0044	U0150	subsp. *subinermis*	LR	0,303	2	1,8	1,9	1	N48.68253	E16.94192	157	CZE
UP0045	U0151	subsp. *subinermis*	LR	0,303	2	1,1	2,0	1	N48.66864	E16.93900	154	CZE
	U0152	subsp. *subinermis*	LR	0,306	2	1,3	2,3	1	N48.66864	E16.93900	154	CZE
UP0046	U0153	subsp. *dioica*	LR	0,577	4	1,6	2,1	1	N48.68192	E16.94289	166	CZE
UP0047	U0154	subsp. *dioica*	LR	0,578	4	0,9	4,7	1	N48.66022	E16.96514	177	CZE
	U0155	subsp. *dioica*	LR	0,579	4	0,9	4,5	1	N48.66022	E16.96514	177	CZE
	U3375	subsp. *dioica*	LR	0,565	4	1,1	1,3	1	N48.66022	E16.96514	177	CZE
UP0048	U0156	subsp. *dioica*	LR	0,577	4	0,9	1,5	1	N48.61758	E16.94042	155	CZE
	U0157	subsp. *dioica*	LR	0,564	4	1,6	2,4	1	N48.61758	E16.94042	155	CZE
UP0049	U0158	subsp. *subinermis*	LR	0,301	2	0,9	1,8	1	N48.61847	E16.94081	155	CZE
	U0159	subsp. *subinermis*	LR	0,310	2	1,3	3,4	1	N48.61847	E16.94081	155	CZE
UP0050	U0160	subsp. *subinermis*	LR	0,297	2	1,2	2,6	1	N48.61850	E16.94103	156	CZE
	U0161	subsp. *subinermis*	LR	0,304	2	1,3	2,3	1	N48.61850	E16.94103	156	CZE
UP0051	U0162	subsp. *subinermis*	LR	0,303	2	1,2	2,2	1	N48.61906	E16.93828	151	CZE
	U0163	subsp. *subinermis*	LR	0,301	2	1,0	1,7	1	N48.61906	E16.93828	151	CZE
UP0052	U0164	subsp. *subinermis*	LR	0,299	2	1,8	2,8	1	N48.61964	E16.93839	156	CZE
	U0165	subsp. *subinermis*	LR	0,308	2	1,5	3,5	1	N48.61964	E16.93839	156	CZE
UP0053	U0166	subsp. *subinermis*	LR	0,302	2	0,8	1,9	1	N48.62306	E16.93511	152	CZE
	U0167	subsp. *subinermis*	LR	0,290	2	1,7	2,7	1	N48.62306	E16.93511	152	CZE
UP0054	U0168	subsp. *dioica*	LR	0,569	4	1,3	1,6	1	N48.62547	E16.93483	152	CZE
UP0055	U0169	subsp. *subinermis*	LR	0,309	2	1,2	2,6	1	N48.63050	E16.95122	150	CZE
UP0056	U0170	subsp. *subinermis*	LR	0,300	2	1,7	2,7	1	N48.63069	E16.95033	150	CZE
	U1336	subsp. *dioica*	LR	0,570	4	1,7	2,3	1	N48.63069	E16.95033	150	CZE
	U1337	subsp. *dioica*	LR	0,594	4	1,3	2,6	1	N48.63069	E16.95033	150	CZE
UP0057	U0171	subsp. *dioica*	LR	0,581	4	1,2	1,3	1	N48.63972	E16.95794	156	CZE
	U0172	subsp. *dioica*	LR	0,575	4	1,1	1,8	1	N48.63972	E16.95794	156	CZE
UP0058	U0173	subsp. *subinermis*	LR	0,310	2	0,9	2,6	1	N48.64958	E16.96333	171	CZE
UP0059	U0174	subsp. *subinermis*	LR	0,308	2	1,0	2,7	1	N48.66172	E16.95553	154	CZE
UP0060	U0175	subsp. *subinermis*	LR	0,308	2	0,9	2,7	1	N48.70031	E16.96467	165	CZE
	U0176	subsp. *subinermis*	LR	0,306	2	1,0	2,9	1	N48.70031	E16.96467	165	CZE
	U3373	subsp. *dioica*	LR	0,572	4	1,0	1,9	1	N48.70031	E16.96467	165	CZE
UP0061	U0177	subsp. *dioica*	LR	0,573	4	1,3	4,0	1	N48.66000	E16.93594	153	CZE
UP0062	U0178	subsp. *dioica*	LR	0,568	4	1,2	1,2	1	N48.65686	E16.93314	151	CZE
	U0179	subsp. *subinermis*	LR	0,306	2	0,9	2,5	1	N48.65686	E16.93314	151	CZE
	U3374	subsp. *dioica*	LR	0,614	4	1,3	2,7	1	N48.65686	E16.93314	151	CZE
UP0063	U0180	subsp. *dioica*	LR	0,577	4	0,8	1,4	1	N48.62083	E16.94406	158	CZE
	U0181	subsp. *dioica*	LR	0,577	4	1,8	1,5	1	N48.62083	E16.94406	158	CZE
UP0064	U0182	subsp. *subinermis*	LR	0,301	2	1,1	2,1	1	N48.64000	E16.94053	151	CZE
	U0183	subsp. *subinermis*	LR	0,311	2	1,3	3,7	1	N48.64000	E16.94053	151	CZE
UP0065	U0184	subsp. *subinermis*	LR	0,324	2	2,2	4,6	1	N48.64742	E16.93908	152	CZE
	U0185	subsp. *dioica*	LR	0,565	4	1,2	1,4	1	N48.64742	E16.93908	152	CZE

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	U0620	subsp. *subinermis*	LR	0,314	2	2,7	4,2	1	N48.64742	E16.93908	152	CZE
UP0066	U0186	subsp. *subinermis*	LR	0,305	2	0,9	1,9	1	N48.65292	E16.94225	159	CZE
UP0067	U0187	subsp. *subinermis*	LR	0,309	2	1,1	1,9	1	N48.65369	E16.94275	166	CZE
UP0068	U0188	subsp. *subinermis*	LR	0,309	2	0,8	2,5	1	N48.65456	E16.94178	161	CZE
UP0069	U0189	subsp. *subinermis*	LR	0,304	2	1,2	2,2	1	N48.67939	E16.96081	152	CZE
	U0619	subsp. *subinermis*	LR	0,299	2	0,8	2,0	1	N48.67939	E16.96081	152	CZE
UP0070	U0190	subsp. *subinermis*	LR	0,300	2	0,9	2,7	1	N48.67969	E16.95192	151	CZE
UP0071	U0191	subsp. *subinermis*	LR	0,293	2	1,5	2,8	1	N50.28453	E14.50793	168	CZE
UP0072	U0192	subsp. *dioica*	LR	0,570	4	1,3	1,7	1	N50.27928	E14.51105	169	CZE
UP0073	U0193	subsp. *subinermis*	LR	0,293	2	1,5	2,3	1	N50.28708	E14.51275	168	CZE
UP0074	U0194	subsp. *subinermis*	LR	0,293	2	1,4	2,7	1	N50.28723	E14.50978	168	CZE
UP0075	U0195	subsp. *subinermis*	LR	0,294	2	1,2	2,8	1	N50.28649	E14.51192	168	CZE
UP0076	U0196	subsp. *subinermis*	LR	0,296	2	1,4	2,4	1	N50.18081	E14.78856	184	CZE
	U1039	subsp. *subinermis*	LR	0,290	2	1,5	2,5	1	N50.18081	E14.78856	183	CZE
	U1040	subsp. *subinermis*	LR	0,302	2	1,4	2,2	1	N50.18081	E14.78856	183	CZE
	U1041	subsp. *dioica*	LR	0,565	4	1,9	1,6	1	N50.18081	E14.78856	183	CZE
UP0077	U0197	subsp. *subinermis*	LR	0,291	2	1,5	3,7	1	N50.18072	E14.78853	184	CZE
	U1036	subsp. *subinermis*	LR	0,293	2	1,1	2,2	1	N50.18072	E14.78853	184	CZE
	U1037	subsp. *subinermis*	LR	0,299	2	1,2	2,3	1	N50.18072	E14.78853	184	CZE
	U1038	subsp. *subinermis*	LR	0,298	2	1,1	2,5	1	N50.18072	E14.78853	184	CZE
UP0078	U0198	subsp. *dioica*	LR	0,566	4	1,2	1,8	1	N50.18098	E14.78585	184	CZE
UP0079	U0199	subsp. *dioica*	LR	0,572	4	1,9	2,8	1	N50.18042	E14.79227	184	CZE
UP0080	U0200	subsp. *dioica*	LR	0,565	4	1,4	1,9	1	N50.18140	E14.78342	184	CZE
UP0081	U0201	subsp. *subinermis*	LR	0,295	2	1,5	2,3	1	N50.18209	E14.78067	184	CZE
UP0082	U0202	subsp. *subinermis*	LR	0,290	2	1,3	2,8	1	N50.39769	E14.08208	167	CZE
	U0203	subsp. *subinermis*	LR	0,290	2	1,3	2,8	1	N50.39769	E14.08208	167	CZE
	U0643	subsp. *subinermis*	LR	0,295	2	1,1	3,4	1	N50.39769	E14.08208	167	CZE
	U0644	subsp. *subinermis*	LR	0,291	2	1,4	2,9	1	N50.39769	E14.08208	167	CZE
	U0645	subsp. *dioica*	LR	0,571	4	1,5	2,0	1	N50.39769	E14.08208	167	CZE
	U0646	subsp. *subinermis*	LR	0,295	2	1,5	2,7	1	N50.39769	E14.08208	167	CZE
UP0083	U0204	subsp. *subinermis*	LR	0,296	2	1,2	2,7	1	N50.39681	E14.08744	167	CZE
	U0908	subsp. *subinermis*	LR	0,304	2	1,2	2,6	1	N50.39681	E14.08744	169	CZE
	U0909	subsp. *subinermis*	LR	0,301	2	2,0	2,7	1	N50.39681	E14.08744	169	CZE
	U0910	subsp. *subinermis*	LR	0,300	2	1,4	2,8	1	N50.39681	E14.08744	169	CZE
	U0911	subsp. *subinermis*	LR	0,293	2	1,5	2,5	1	N50.39681	E14.08744	169	CZE
	U0912	subsp. *subinermis*	LR	0,297	2	1,2	2,9	1	N50.39681	E14.08744	169	CZE
	U0913	subsp. *subinermis*	LR	0,295	2	1,3	3,1	1	N50.39681	E14.08744	169	CZE
UP0084	U0205	subsp. *subinermis*	LR	0,296	2	1,3	2,9	1	N50.39711	E14.08478	167	CZE
	U0206	subsp. *subinermis*	LR	0,296	2	1,3	2,9	1	N50.39711	E14.08478	167	CZE
	U0984	subsp. *subinermis*	LR	0,294	2	2,2	2,9	1	N50.39711	E14.08478	168	CZE
	U0985	subsp. *subinermis*	LR	0,295	2	1,7	3,5	1	N50.39711	E14.08478	168	CZE

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	U0986	subsp. *dioica*	LR	0,568	4	1,3	2,3	1	N50.39711	E14.08478	168	CZE
	U0987	subsp. *subinermis*	LR	0,291	2	1,4	2,4	1	N50.39711	E14.08478	168	CZE
	U0988	subsp. *subinermis*	LR	0,293	2	1,3	2,8	1	N50.39711	E14.08478	168	CZE
	U0989	subsp. *subinermis*	LR	0,292	2	1,5	3,1	1	N50.39711	E14.08478	168	CZE
UP0085	U0207	subsp. *dioica*	LR	0,570	4	1,5	2,2	1	N50.39611	E14.07474	167	CZE
UP0086	U0208	subsp. *dioica*	LR	0,559	4	1,4	1,7	1	N50.39353	E14.07360	167	CZE
UP0087	U0209	subsp. *dioica* aneuploid	LR	0,501	–	1,5	1,8	1	N50.39613	E14.08119	167	CZE
UP0088	U0210	subsp. *dioica*	LR	0,564	4	1,3	1,9	1	N50.39478	E14.08373	167	CZE
UP0089	U0211	subsp. *dioica*	LR	0,569	4	1,3	1,7	1	N50.39305	E14.08064	167	CZE
UP0090	U0212	subsp. *subinermis*	LR	0,290	2	1,2	2,5	1	N50.17308	E14.85827	189	CZE
UP0091	U0213	subsp. *subinermis*	LR	0,293	2	1,5	4,9	1	N50.17310	E14.85843	189	CZE
	U0214	subsp. *dioica*	LR	0,565	4	1,5	2,6	1	N50.17310	E14.85843	189	CZE
UP0092	U0215	subsp. *subinermis*	LR	0,306	2	1,1	3,7	1	N50.17085	E14.86102	190	CZE
	U3673	subsp. *dioica*	LR	0,558	4	1,2	2,3	1	N50.17085	E14.86102	190	CZE
UP0093	U0216	subsp. *dioica*	LR	0,621	4	1,5	3,2	1	N50.32237	E14.46868	160	CZE
	U0217	subsp. *dioica*	LR	0,582	4	1,8	2,8	1	N50.32237	E14.46868	160	CZE
UP0094	U0218	subsp. *dioica*	LR	0,559	4	1,8	2,2	1	N50.42394	E14.13639	166	CZE
UP0095	U0219	subsp. *dioica*	LR	0,564	4	1,1	1,6	1	N50.41921	E14.13407	166	CZE
UP0096	U0220	subsp. *dioica*	LR	0,558	4	1,7	1,5	1	N50.43053	E14.14561	166	CZE
UP0097	U0221	subsp. *dioica*	LR	0,558	4	1,4	2,1	1	N50.42288	E14.14347	166	CZE
UP0098	U0222	subsp. *dioica*	LR	0,574	4	1,5	1,9	1	N50.41996	E14.14203	166	CZE
UP0099	U0223	subsp. *dioica*	LR	0,555	4	1,1	2,2	1	N50.41632	E14.12938	166	CZE
UP0100	U0224	subsp. *dioica*	LR	0,568	4	1,3	1,4	1	N50.41264	E14.12133	166	CZE
UP0101	U0225	subsp. *dioica*	LR	0,564	4	1,7	1,7	1	N50.42683	E14.14666	166	CZE
UP0102	U0226	subsp. *subinermis*	LR	0,296	2	1,2	2,9	1	N50.24703	E14.54956	2	CZE
	U0811	subsp. *dioica*	LR	0,556	4	1,3	2,3	4	N50.24703	E14.54956	165	CZE
	U0812	subsp. *dioica*	LR	0,556	4	1,3	2,3	4	N50.24703	E14.54956	165	CZE
	U0813	subsp. *dioica*	LR	0,556	4	1,3	2,3	4	N50.24703	E14.54956	165	CZE
	U0814	subsp. *dioica*	LR	0,556	4	1,3	2,3	4	N50.24703	E14.54956	165	CZE
UP0103	U0227	subsp. *subinermis*	LR	0,296	2	1,3	2,8	1	N50.24606	E14.54842	2	CZE
	U0966	subsp. *dioica*	LR	0,562	4	1,4	1,8	1	N50.24606	E14.54842	166	CZE
	U0967	subsp. *subinermis*	LR	0,311	2	1,0	2,8	1	N50.24606	E14.54842	166	CZE
	U0968	subsp. *dioica*	LR	0,562	4	1,6	2,3	1	N50.24606	E14.54842	166	CZE
	U3628	subsp. *subinermis*	LR	0,296	2	1,7	3,0	1	N50.24606	E14.54842	166	CZE
UP0104	U0228	subsp. *subinermis*	LR	0,294	2	1,2	2,9	1	N50.24522	E14.54767	2	CZE
	U0721	subsp. *subinermis*	LR	0,292	2	1,4	2,8	1	N50.24522	E14.54767	164	CZE
	U0722	subsp. *subinermis*	LR	0,292	2	1,4	2,4	1	N50.24522	E14.54767	164	CZE
	U0723	subsp. *subinermis*	LR	0,309	2	1,6	4,6	1	N50.24522	E14.54767	164	CZE
	U0724	subsp. *dioica*	LR	0,563	4	1,4	1,8	1	N50.24522	E14.54767	164	CZE
	U3629	subsp. *subinermis*	LR	0,297	2	1,9	2,2	1	N50.24522	E14.54767	164	CZE
UP0105	U0229	subsp. *subinermis*	LR	0,293	2	1,7	2,8	1	N50.24383	E14.54761	2	CZE

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	U1323	subsp. *dioica*	LR	0,549	4	1,6	2,5	5	N50.24383	E14.54761	164	CZE
	U1324	subsp. *dioica*	LR	0,549	4	1,6	2,5	5	N50.24383	E14.54761	164	CZE
	U1325	subsp. *dioica*	LR	0,549	4	1,6	2,5	5	N50.24383	E14.54761	164	CZE
	U1326	subsp. *dioica*	LR	0,549	4	1,6	2,5	5	N50.24383	E14.54761	164	CZE
	U1327	subsp. *dioica*	LR	0,549	4	1,6	2,5	5	N50.24383	E14.54761	164	CZE
UP0106	U0230	subsp. *subinermis*	LR	0,294	2	1,6	2,8	1	N50.24169	E14.54850	2	CZE
	U0735	subsp. *dioica*	LR	0,562	4	1,6	2,2	4	N50.24169	E14.54850	166	CZE
	U0736	subsp. *dioica*	LR	0,562	4	1,6	2,2	4	N50.24169	E14.54850	166	CZE
	U0737	subsp. *dioica*	LR	0,562	4	1,6	2,2	4	N50.24169	E14.54850	166	CZE
	U0738	subsp. *dioica*	LR	0,562	4	1,6	2,2	4	N50.24169	E14.54850	166	CZE
UP0107	U0235	subsp. *dioica*	JC	0,569	4	1,3	2,5	1	N47.40778	E25.51889	761	ROU
UP0108	U0236	subsp. *dioica*	HD	0,569	4	0,9	2,4	1	N47.82103	E15.29414	790	AUT
	U0237	subsp. *dioica*	HD	0,616	4	1,3	4,5	1	N47.82103	E15.29414	790	AUT
	U1388	subsp. *dioica*	LR	0,584	4	1,1	3,5	1	N47.82103	E15.29414	790	AUT
	U1389	subsp. *dioica*	LR	0,536	4	1,7	2,3	1	N47.82103	E15.29414	790	AUT
	U1390	subsp. *dioica*	LR	0,602	4	1,2	4,6	1	N47.82103	E15.29414	790	AUT
	U1391	subsp. *dioica*	LR	0,598	4	2,2	3,7	1	N47.82103	E15.29414	790	AUT
	U1392	subsp. *dioica*	LR	0,607	4	1,1	3,8	1	N47.82103	E15.29414	790	AUT
	U1393	subsp. *dioica*	LR	0,592	4	0,8	2,5	1	N47.82103	E15.29414	790	AUT
	U1394	subsp. *dioica*	LR	0,601	4	1,5	4,0	1	N47.82103	E15.29414	790	AUT
	U1395	subsp. *dioica*	LR	0,596	4	1,7	2,4	1	N47.82103	E15.29414	790	AUT
UP0109	U0238	subsp. *dioica*	FK	0,604	4	1,7	3,3	1	N54.18744	E15.64299	14	POL
	U1550	subsp. *dioica*	FK	0,599	4	1,1	1,6	1	N54.18744	E15.64299	14	POL
	U1551	subsp. *dioica*	FK	0,594	4	1,0	3,5	1	N54.18744	E15.64299	14	POL
UP0110	U0239	subsp. *dioica*	EZ, FK	0,580	4	1,0	1,9	1	N55.43510	E13.91231	3	SWE
	U1562	subsp. *dioica*	EZ, FK	0,591	4	1,5	2,3	1	N55.43510	E13.91231	3	SWE
	U1563	subsp. *dioica*	EZ, FK	0,590	4	1,3	2,9	1	N55.43510	E13.91231	3	SWE
	U1564	subsp. *dioica*	EZ, FK	0,595	4	0,9	2,8	1	N55.43510	E13.91231	3	SWE
	U1565	subsp. *dioica*	EZ, FK	0,596	4	1,1	1,8	1	N55.43510	E13.91231	3	SWE
	U1566	subsp. *dioica*	EZ, FK	0,607	4	1,9	2,8	1	N55.43510	E13.91231	3	SWE
	U1567	subsp. *dioica*	EZ, FK	0,574	4	1,2	1,8	1	N55.43510	E13.91231	3	SWE
UP0111	U0241	subsp. *dioica*	EZ, FK	0,557	4	1,6	2,4	1	N55.65750	E14.26973	38	SWE
	U1559	subsp. *dioica*	EZ, FK	0,585	4	1,1	1,9	1	N55.65750	E14.26973	38	SWE
	U1561	subsp. *dioica*	EZ, FK	0,602	4	1,4	2,4	1	N55.65750	E14.26973	38	SWE
UP0112	U0242	subsp. *dioica*	FK	0,599	4	1,1	2,3	1	N54.46198	E18.56100	11	POL
	U1570	subsp. *dioica*	EZ, FK	0,576	4	1,3	2,6	1	N54.46198	E18.56100	11	POL
	U1571	subsp. *dioica*	EZ, FK	0,574	4	1,0	3,9	1	N54.46198	E18.56100	11	POL
	U1572	subsp. *dioica*	EZ, FK	0,581	4	1,9	2,4	1	N54.46198	E18.56100	11	POL
	U1573	subsp. *dioica*	EZ, FK	0,588	4	0,9	3,1	1	N54.46198	E18.56100	11	POL
UP0113	U0243	subsp. *dioica*	EZ, FK	0,584	4	1,0	3,5	1	N54.28356	E16.13995	2	POL
	U1558	subsp. *dioica*	EZ, FK	0,562	4	1,2	1,5	1	N54.28356	E16.13995	2	POL

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	U1568	subsp. *dioica*	EZ, FK	0,578	4	1,0	3,1	1	N54.28356	E16.13995	2	POL
	U1569	subsp. *dioica*	EZ, FK	0,576	4	0,9	3,3	1	N54.28356	E16.13995	2	POL
UP0114	U0252	subsp. *dioica*	FK	0,561	4	1,7	2,4	1	N43.68972	E18.26778	1575	BIH
	U0253	subsp. *dioica*	FK	0,555	4	1,2	1,8	1	N43.68972	E18.26778	1575	BIH
	U0254	subsp. *dioica*	FK	0,604	4	1,3	3,3	1	N43.68972	E18.26778	1575	BIH
	U0255	subsp. *dioica*	FK	0,566	4	1,5	2,2	1	N43.68972	E18.26778	1575	BIH
	U0256	subsp. *dioica*	FK	0,564	4	1,1	2,8	1	N43.68972	E18.26778	1575	BIH
	U0257	subsp. *dioica*	FK	0,574	4	1,3	2,3	1	N43.68972	E18.26778	1575	BIH
UP0115	U0258	subsp. *dioica*	FK	0,572	4	0,8	1,4	1	N55.65798	E14.26849	44	SWE
	U0259	subsp. *dioica*	FK	0,573	4	1,0	1,4	1	N55.65798	E14.26849	44	SWE
UP0116	U0260	subsp. *pubescens*	LR	0,302	2	1,3	1,7	1	N46.11230	E13.11230	129	ITA
	U0261	subsp. *pubescens*	LR	0,300	2	0,6	1,4	1	N46.11230	E13.11230	129	ITA
	U0262	subsp. *dioica* triploid	LR	0,446	3	0,8	1,0	1	N46.11230	E13.11230	129	ITA
UP0117	U0264	subsp. *dioica*	RB	0,578	4	0,8	2,3	1	N46.43976	E13.75280	1424	SVN
	U0265	subsp. *dioica*	RB	0,584	4	0,8	2,4	1	N46.43976	E13.75280	1424	SVN
	U0266	subsp. *dioica*	RB	0,576	4	0,8	1,6	1	N46.43976	E13.75280	1424	SVN
	U0267	subsp. *dioica*	RB	0,567	4	1,2	1,9	1	N46.43976	E13.75280	1424	SVN
UP0118	U0268	subsp. *dioica*	RB	0,617	4	0,8	1,4	1	N46.44113	E13.74176	1808	SVN
	U0269	subsp. *dioica*	RB	0,589	4	0,9	2,0	1	N46.44113	E13.74176	1808	SVN
	U0270	subsp. *dioica*	RB	0,597	4	1,0	1,8	1	N46.44113	E13.74176	1808	SVN
UP0119	U0271	subsp. *dioica*	RB	0,574	4	0,8	2,3	1	N46.44071	E13.72535	1676	SVN
	U0272	subsp. *dioica*	RB	0,586	4	1,9	2,8	1	N46.44071	E13.72535	1676	SVN
UP0120	U0273	subsp. *dioica*	RB	0,577	4	1,1	2,0	1	N46.43723	E13.71337	1303	SVN
	U0274	subsp. *dioica*	RB	0,590	4	1,0	1,9	1	N46.43723	E13.71337	1303	SVN
	U0275	subsp. *dioica*	RB	0,595	4	0,9	2,8	1	N46.43723	E13.71337	1303	SVN
	U0276	subsp. *dioica*	RB	0,592	4	1,4	1,9	1	N46.43723	E13.71337	1303	SVN
UP0121	U0277	subsp. *dioica*	RB	0,589	4	1,3	1,8	1	N45.86386	E14.26443	458	SVN
	U0278	subsp. *dioica*	RB	0,581	4	1,1	2,2	1	N45.86386	E14.26443	458	SVN
	U0279	subsp. *dioica*	RB	0,620	4	1,5	2,4	1	N45.86386	E14.26443	458	SVN
UP0122	U0280	subsp. *dioica*	RB	0,598	4	1,7	2,5	1	N45.87358	E14.24645	509	SVN
	U0281	subsp. *dioica*	RB	0,601	4	1,7	2,9	1	N45.87358	E14.24645	509	SVN
	U0282	subsp. *dioica*	RB	0,591	4	1,0	2,5	1	N45.87358	E14.24645	509	SVN
UP0123	U0283	subsp. *dioica*	RB	0,585	4	1,4	1,6	1	N44.37374	E15.46575	1375	HRV
	U0284	subsp. *dioica*	RB	0,564	4	1,1	2,1	1	N44.37374	E15.46575	1375	HRV
	U0285	subsp. *dioica*	RB	0,575	4	1,0	2,6	1	N44.37374	E15.46575	1375	HRV
	U0286	subsp. *dioica*	RB	0,579	4	1,2	1,9	1	N44.37374	E15.46575	1375	HRV
UP0124	U0287	subsp. *dioica*	RB	0,583	4	1,0	1,4	1	N45.82611	E14.24901	454	SVN
	U0288	subsp. *dioica*	RB	0,581	4	0,8	1,2	1	N45.82611	E14.24901	454	SVN
	U0289	subsp. *dioica*	RB	0,572	4	1,2	2,2	1	N45.82611	E14.24901	454	SVN
	U0290	subsp. *dioica*	RB	0,571	4	0,9	3,9	1	N45.82611	E14.24901	377	SVN
	U0291	subsp. *dioica*	RB	0,598	4	1,2	2,8	1	N45.82611	E14.24901	454	SVN

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UP0125	U0292	subsp. *dioica*	RB	0,599	4	0,9	2,1	1	N44.76531	E15.21866	501	HRV
	U0293	subsp. *dioica*	RB	0,606	4	1,2	2,3	1	N44.76531	E15.21866	501	HRV
UP0126	U0294	subsp. *dioica*	LR	0,606	4	1,2	2,8	1	N48.39592	E21.75039	98	SVK
	U0365	subsp. *subinermis*	LR	0,296	2	1,9	2,3	1	N48.39592	E21.75039	98	SVK
	U0366	subsp. *subinermis*	LR	0,296	2	1,5	2,4	1	N48.39592	E21.75039	98	SVK
UP0127	U0295	subsp. *dioica*	LR	0,584	4	1,2	2,5	1	N48.49319	E22.07675	99	SVK
	U0371	subsp. *subinermis*	LR	0,308	2	1,3	4,1	1	N48.49319	E22.07675	99	SVK
	U0372	subsp. *subinermis*	LR	0,301	2	1,0	2,2	1	N48.49319	E22.07675	99	SVK
	U0373	subsp. *subinermis*	LR	0,297	2	1,0	1,9	1	N48.49319	E22.07675	99	SVK
	U0374	subsp. *subinermis*	LR	0,298	2	1,7	1,8	1	N48.49319	E22.07675	99	SVK
	U0375	subsp. *subinermis*	LR	0,298	2	1,2	2,6	1	N48.49319	E22.07675	99	SVK
	U0376	subsp. *subinermis*	LR	0,298	2	1,2	1,9	1	N48.49319	E22.07675	99	SVK
	U0377	subsp. *dioica*	LR	0,568	4	1,3	1,7	1	N48.49319	E22.07675	99	SVK
UP0128	U0296	subsp. *dioica*	LR	0,578	4	1,3	4,2	1	N48.52582	E22.05363	100	SVK
	U0297	subsp. *dioica*	LR	0,574	4	1,6	2,3	1	N48.52582	E22.05363	100	SVK
	U0298	subsp. *dioica*	LR	0,582	4	1,6	3,1	1	N48.52582	E22.05363	100	SVK
UP0129	U0299	subsp. *subinermis*	LR	0,297	2	1,3	2,6	1	N48.49417	E21.91414	102	SVK
	U0300	subsp. *subinermis*	LR	0,302	2	1,2	2,2	1	N48.49417	E21.91414	102	SVK
	U0301	subsp. *subinermis*	LR	0,290	2	1,3	2,8	1	N48.49417	E21.91414	102	SVK
	U0302	subsp. *subinermis*	LR	0,300	2	1,4	2,3	1	N48.49417	E21.91414	102	SVK
	U0303	subsp. *subinermis*	LR	0,303	2	1,3	2,4	1	N48.49417	E21.91414	102	SVK
	U0304	subsp. *subinermis*	LR	0,301	2	1,9	1,8	1	N48.49417	E21.91414	102	SVK
	U0420	subsp. *subinermis*	LR	0,301	2	1,4	2,2	1	N48.49417	E21.91414	102	SVK
	U0421	subsp. *subinermis*	LR	0,295	2	1,5	2,0	1	N48.49417	E21.91414	102	SVK
UP0130	U0306	subsp. *subinermis*	LR	0,290	2	1,3	2,2	1	N48.56303	E21.92361	99	SVK
	U0307	subsp. *subinermis*	LR	0,294	2	1,3	2,4	1	N48.56303	E21.92361	99	SVK
	U0308	subsp. *subinermis*	LR	0,293	2	1,4	2,4	1	N48.56303	E21.92361	99	SVK
UP0131	U0309	subsp. *dioica*	LR	0,568	4	1,4	1,9	1	N48.56621	E21.94052	107	SVK
	U0310	subsp. *subinermis*	LR	0,295	2	1,4	2,4	1	N48.56621	E21.94052	107	SVK
	U0433	subsp. *subinermis*	LR	0,294	2	1,1	2,4	1	N48.56621	E21.94052	107	SVK
UP0132	U0311	subsp. *subinermis*	LR	0,300	2	1,4	2,7	6	N48.49647	E21.87483	99	SVK
UP0133	U0312	subsp. *subinermis*	LR	0,296	2	1,3	1,8	1	N48.49114	E21.84125	99	SVK
	U0313	subsp. *subinermis*	LR	0,296	2	1,6	1,9	1	N48.49114	E21.84125	99	SVK
	U0314	subsp. *subinermis*	LR	0,300	2	1,1	2,1	1	N48.49114	E21.84125	99	SVK
	U0315	subsp. *subinermis*	LR	0,294	2	1,4	2,0	1	N48.49114	E21.84125	99	SVK
	U0316	subsp. *dioica*	LR	0,574	4	1,3	1,7	1	N48.49114	E21.84125	99	SVK
	U0317	subsp. *subinermis*	LR	0,303	2	1,3	2,2	1	N48.49114	E21.84125	99	SVK
	U0318	subsp. *subinermis*	LR	0,295	2	1,3	2,0	1	N48.49114	E21.84125	99	SVK
	U0319	subsp. *subinermis*	LR	0,300	2	1,2	2,2	1	N48.49114	E21.84125	99	SVK
	U0437	subsp. *subinermis*	LR	0,308	2	0,9	4,2	1	N48.49114	E21.84125	99	SVK
	U0438	subsp. *dioica*	LR	0,571	4	1,2	1,7	1	N48.49114	E21.84125	99	SVK

ID number of population	ID number of analysis	Taxon	Collector	Relative fluorescence intensity	DNA-ploidy level	CV of standard	CV of sample	N. of individuals in analysis	Latitude (WGS-84)	Longitude (WGS-84)	Altitude (m a.s.l.)	Country (ISO 3166-1)
UP0134	U0320	subsp. *subinermis*	LR	0,304	2	1,7	1,9	1	N48.48933	E21.86347	98	SVK
	U0321	subsp. *subinermis*	LR	0,308	2	1,3	4,1	1	N48.48933	E21.86347	98	SVK
	U0322	subsp. *subinermis*	LR	0,295	2	1,1	2,0	1	N48.48933	E21.86347	98	SVK
	U0323	subsp. *subinermis*	LR	0,305	2	1,0	2,7	1	N48.48933	E21.86347	98	SVK
	U0324	subsp. *dioica*	LR	0,569	4	1,0	1,4	1	N48.48933	E21.86347	98	SVK
	U0325	subsp. *dioica*	LR	0,575	4	1,3	3,8	1	N48.48933	E21.86347	98	SVK
	U0326	subsp. *dioica*	LR	0,583	4	1,3	1,6	1	N48.48933	E21.86347	98	SVK
	U0327	subsp. *subinermis*	LR	0,310	2	1,0	4,5	1	N48.48933	E21.86347	98	SVK
	U0328	subsp. *dioica*	LR	0,573	4	1,0	1,4	1	N48.48933	E21.86347	98	SVK
	U0329	subsp. *dioica*	LR	0,594	4	1,2	2,2	1	N48.48933	E21.86347	98	SVK
	U0330	subsp. *dioica*	LR	0,566	4	1,2	1,6	1	N48.48933	E21.86347	98	SVK
	U3499	subsp. *subinermis*	LR	0,299	2	1,5	2,3	5	N48.48933	E21.86347	98	SVK
UP0135	U0331	subsp. *dioica*	LR	0,560	4	1,3	1,8	1	N48.48892	E21.85806	97	SVK
	U0332	subsp. *subinermis*	LR	0,296	2	1,1	2,5	1	N48.48892	E21.85806	97	SVK
	U0333	subsp. *subinermis*	LR	0,290	2	1,9	1,7	1	N48.48892	E21.85806	97	SVK
	U0334	subsp. *subinermis*	LR	0,294	2	1,3	2,2	1	N48.48892	E21.85806	97	SVK
	U0335	subsp. *subinermis*	LR	0,295	2	1,4	2,1	1	N48.48892	E21.85806	97	SVK
	U0336	subsp. *dioica*	LR	0,568	4	1,9	1,8	1	N48.48892	E21.85806	97	SVK
	U0337	subsp. *subinermis*	LR	0,295	2	1,1	1,8	1	N48.48892	E21.85806	97	SVK
	U0338	subsp. *subinermis*	LR	0,291	2	1,2	1,9	1	N48.48892	E21.85806	97	SVK
	U0439	subsp. *subinermis*	LR	0,293	2	1,3	2,4	1	N48.48892	E21.85806	97	SVK
	U0440	subsp. *subinermis*	LR	0,297	2	1,1	2,7	1	N48.48892	E21.85806	97	SVK
UP0136	U0339	subsp. *dioica*	LR	0,561	4	0,9	1,4	1	N48.48475	E21.84961	98	SVK
	U0340	subsp. *subinermis*	LR	0,290	2	1,3	2,3	1	N48.48475	E21.84961	98	SVK
	U0341	subsp. *subinermis*	LR	0,293	2	1,4	1,9	1	N48.48475	E21.84961	98	SVK
	U0342	subsp. *subinermis*	LR	0,292	2	1,4	2,2	1	N48.48475	E21.84961	98	SVK
	U0343	subsp. *subinermis*	LR	0,289	2	1,2	1,8	1	N48.48475	E21.84961	98	SVK
	U0344	subsp. *subinermis*	LR	0,292	2	1,3	1,7	1	N48.48475	E21.84961	98	SVK
	U0345	subsp. *dioica*	LR	0,562	4	1,2	1,5	1	N48.48475	E21.84961	98	SVK
	U0346	subsp. *dioica*	LR	0,572	4	1,2	1,9	1	N48.48475	E21.84961	98	SVK
UP0137	U0347	subsp. *subinermis*	LR	0,301	2	1,2	2,6	1	N48.43256	E21.81092	96	SVK
	U0348	subsp. *subinermis*	LR	0,301	2	1,3	2,2	1	N48.43256	E21.81092	96	SVK
	U3495	subsp. *subinermis*	LR	0,302	2	1,0	2,7	1	N48.43256	E21.81092	96	SVK
UP0138	U0349	subsp. *subinermis*	LR	0,298	2	1,1	2,1	1	N48.43264	E21.81125	97	SVK
	U0350	subsp. *subinermis*	LR	0,299	2	1,5	2,5	1	N48.43264	E21.81125	97	SVK
	U0351	subsp. *subinermis*	LR	0,315	2	1,4	2,9	1	N48.43264	E21.81125	97	SVK
UP0139	U0352	subsp. *dioica*	LR	0,576	4	1,3	1,9	4	N48.43898	E22.05241	99	SVK
	U0353	subsp. *dioica*	LR	0,576	4	1,3	1,9	4	N48.43898	E22.05241	99	SVK
	U0354	subsp. *dioica*	LR	0,576	4	1,3	1,9	4	N48.43898	E22.05241	99	SVK
UP0140	U0355	subsp. *dioica*	LR	0,560	4	1,2	1,6	1	N48.37817	E21.75256	96	SVK
UP0141	U0356	subsp. *dioica*	LR	0,567	4	1,2	2,1	1	N48.38456	E21.72042	98	SVK

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	U0357	subsp. *dioica*	LR	0,569	4	1,4	1,9	2	N48.38456	E21.72042	98	SVK
	U0358	subsp. *dioica*	LR	0,569	4	1,4	1,9	2	N48.38456	E21.72042	98	SVK
UP0142	U0359	subsp. *dioica*	LR	0,569	4	1,5	2,2	1	N48.38431	E21.71758	98	SVK
	U0360	subsp. *dioica*	LR	0,569	4	1,5	2,2	1	N48.38431	E21.71758	98	SVK
	U0361	subsp. *dioica*	LR	0,569	4	1,5	2,2	1	N48.38431	E21.71758	98	SVK
	U0362	subsp. *subinermis*	LR	0,300	2	1,5	2,2	1	N48.38431	E21.71758	98	SVK
	U3487	subsp. *dioica*	LR	0,562	4	1,6	1,8	1	N48.38431	E21.71758	98	SVK
UP0143	U0363	subsp. *dioica*	LR	0,571	4	1,7	1,6	2	N48.39672	E21.80689	99	SVK
	U0364	subsp. *dioica*	LR	0,571	4	1,7	1,6	2	N48.39672	E21.80689	99	SVK
UP0144	U0367	subsp. *dioica*	LR	0,556	4	1,7	1,8	1	N48.40111	E21.77503	97	SVK
	U0368	subsp. *dioica*	LR	0,559	4	1,8	1,8	1	N48.40111	E21.77503	97	SVK
	U0369	subsp. *subinermis*	LR	0,297	2	1,3	2,5	1	N48.40111	E21.77503	97	SVK
	U3489	subsp. *dioica*	LR	0,572	4	1,2	1,8	4	N48.40111	E21.77503	97	SVK
UP0145	U0370	subsp. *subinermis*	LR	0,295	2	1,9	2,5	1	N48.45681	E21.80497	96	SVK
UP0146	U0378	subsp. *dioica*	LR	0,572	4	1,1	1,9	1	N48.50069	E22.07319	97	SVK
UP0147	U0379	subsp. *dioica*	LR	0,567	4	1,0	2,0	7	N48.50556	E22.05856	104	SVK
	U0380	subsp. *dioica*	LR	0,567	4	1,0	2,0	7	N48.50556	E22.05856	104	SVK
	U0381	subsp. *dioica*	LR	0,567	4	1,0	2,0	7	N48.50556	E22.05856	104	SVK
	U0382	subsp. *dioica*	LR	0,567	4	1,0	2,0	7	N48.50556	E22.05856	104	SVK
	U0383	subsp. *dioica*	LR	0,567	4	1,0	2,0	7	N48.50556	E22.05856	104	SVK
	U0384	subsp. *dioica*	LR	0,567	4	1,0	2,0	7	N48.50556	E22.05856	104	SVK
	U0385	subsp. *dioica*	LR	0,567	4	1,0	2,0	7	N48.50556	E22.05856	104	SVK
UP0148	U0386	subsp. *subinermis*	LR	0,308	2	1,1	3,1	1	N48.47631	E22.10681	106	SVK
	U0387	subsp. *subinermis*	LR	0,294	2	1,2	2,4	1	N48.47631	E22.10681	106	SVK
	U0388	subsp. *subinermis*	LR	0,297	2	1,1	2,6	1	N48.47631	E22.10681	106	SVK
	U0389	subsp. *subinermis*	LR	0,293	2	1,2	2,1	1	N48.47631	E22.10681	106	SVK
	U0390	subsp. *subinermis*	LR	0,296	2	1,1	2,2	1	N48.47631	E22.10681	106	SVK
	U0391	subsp. *subinermis*	LR	0,301	2	1,2	2,2	1	N48.47631	E22.10681	106	SVK
	U0392	subsp. *subinermis*	LR	0,296	2	1,3	2,5	1	N48.47631	E22.10681	106	SVK
	U0393	subsp. *subinermis*	LR	0,298	2	1,7	2,1	1	N48.47631	E22.10681	106	SVK
	U0394	subsp. *subinermis*	LR	0,295	2	1,1	2,4	1	N48.47631	E22.10681	106	SVK
UP0149	U0395	subsp. *subinermis*	LR	0,300	2	1,3	2,5	1	N48.47397	E22.10978	101	SVK
	U0396	subsp. *subinermis*	LR	0,297	2	1,4	2,0	1	N48.47397	E22.10978	101	SVK
	U0397	subsp. *subinermis*	LR	0,299	2	1,9	1,9	1	N48.47397	E22.10978	101	SVK
	U0398	subsp. *subinermis*	LR	0,299	2	1,4	2,1	1	N48.47397	E22.10978	101	SVK
	U3491	subsp. *dioica*	LR	0,571	4	1,4	1,9	1	N48.47397	E22.10978	101	SVK
UP0150	U0399	subsp. *dioica* triploid	LR	0,428	3	1,4	2,0	1	N48.47567	E22.08292	99	SVK
	U0400	subsp. *subinermis*	LR	0,302	2	1,1	2,9	1	N48.47567	E22.08292	99	SVK
	U0401	subsp. *subinermis*	LR	0,299	2	1,4	2,3	1	N48.47567	E22.08292	99	SVK
	U0402	subsp. *subinermis*	LR	0,330	2	1,4	2,5	1	N48.47567	E22.08292	99	SVK
	U0403	subsp. *dioica*	LR	0,566	4	1,1	1,8	1	N48.47567	E22.08292	99	SVK

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	U0404	subsp. *dioica*	LR	0,549	4	1,3	1,6	1	N48.47567	E22.08292	99	SVK
	U3492	subsp. *dioica*	LR	0,572	4	1,1	1,7	1	N48.47567	E22.08292	99	SVK
	U3493	subsp. *dioica*	LR	0,566	4	1,6	2,0	1	N48.47567	E22.08292	99	SVK
UP0151	U0405	subsp. *dioica*	LR	0,569	4	1,5	2,2	4	N48.50586	E22.03997	99	SVK
	U0406	subsp. *dioica*	LR	0,569	4	1,5	2,2	4	N48.50586	E22.03997	99	SVK
	U0407	subsp. *dioica*	LR	0,569	4	1,5	2,2	4	N48.50586	E22.03997	99	SVK
	U0408	subsp. *dioica*	LR	0,569	4	1,5	2,2	4	N48.50586	E22.03997	99	SVK
UP0152	U0409	subsp. *subinermis*	LR	0,347	2	1,3	1,9	1	N48.50389	E21.99969	104	SVK
	U0410	subsp. *subinermis*	LR	0,351	2	1,3	2,0	1	N48.50389	E21.99969	104	SVK
	U0411	subsp. *subinermis*	LR	0,348	2	1,1	1,6	1	N48.50389	E21.99969	104	SVK
	U0412	subsp. *subinermis*	LR	0,350	2	1,3	1,8	1	N48.50389	E21.99969	104	SVK
	U0413	subsp. *subinermis*	LR	0,347	2	1,2	1,9	1	N48.50389	E21.99969	104	SVK
UP0153	U0414	subsp. *dioica*	LR	0,560	4	1,5	2,8	6	N48.50342	E21.99950	106	SVK
	U0415	subsp. *dioica*	LR	0,560	4	1,5	2,8	6	N48.50342	E21.99950	106	SVK
	U0416	subsp. *dioica*	LR	0,560	4	1,5	2,8	6	N48.50342	E21.99950	106	SVK
	U0417	subsp. *dioica*	LR	0,560	4	1,5	2,8	6	N48.50342	E21.99950	106	SVK
	U0418	subsp. *dioica*	LR	0,560	4	1,5	2,8	6	N48.50342	E21.99950	106	SVK
	U0419	subsp. *dioica*	LR	0,560	4	1,5	2,8	6	N48.50342	E21.99950	106	SVK
UP0154	U0422	subsp. *dioica*	LR	0,568	4	0,9	1,5	1	N48.49397	E21.88883	98	SVK
	U0423	subsp. *subinermis*	LR	0,297	2	1,3	1,7	1	N48.49397	E21.88883	98	SVK
UP0155	U0424	subsp. *dioica*	LR	0,570	4	1,2	1,7	1	N48.51689	E21.82989	97	SVK
	U0425	subsp. *dioica*	LR	0,571	4	1,4	2,5	4	N48.52953	E21.85953	98	SVK
	U0426	subsp. *dioica*	LR	0,571	4	1,4	2,5	4	N48.52953	E21.85953	98	SVK
	U0427	subsp. *dioica*	LR	0,571	4	1,4	2,5	4	N48.52953	E21.85953	98	SVK
	U0428	subsp. *dioica*	LR	0,571	4	1,4	2,5	4	N48.52953	E21.85953	98	SVK
UP0157	U0429	subsp. *dioica*	LR	0,568	4	1,3	2,6	2	N48.53208	E21.87092	100	SVK
	U0430	subsp. *dioica*	LR	0,568	4	1,3	2,6	2	N48.53208	E21.87092	100	SVK
UP0158	U0431	subsp. *dioica*	LR	0,569	4	1,4	1,2	2	N48.57586	E21.81897	96	SVK
	U0432	subsp. *dioica*	LR	0,569	4	1,4	1,2	2	N48.57586	E21.81897	96	SVK
UP0159	U0434	subsp. *dioica*	LR	0,561	4	1,2	2,0	3	N48.53100	E21.95314	97	SVK
UP0159	U0435	subsp. *dioica*	LR	0,561	4	1,2	2,0	3	N48.53100	E21.95314	97	SVK
	U0436	subsp. *dioica*	LR	0,561	4	1,2	2,0	3	N48.53100	E21.95314	97	SVK
UP0160	U0441	subsp. *dioica*	LR	0,570	4	1,2	1,7	2	N48.48653	E21.82119	101	SVK
	U0442	subsp. *dioica*	LR	0,570	4	1,2	1,7	2	N48.48653	E21.82119	101	SVK
UP0161	U0443	subsp. *dioica*	PK	0,564	4	1,6	1,4	1	N50.02215	E15.33557	206	CZE
	U0444	subsp. *dioica*	PK	0,556	4	1,8	1,3	1	N50.02215	E15.33557	206	CZE
	U0445	subsp. *dioica*	PK	0,564	4	1,8	1,4	1	N50.02215	E15.33557	206	CZE
	U0446	subsp. *subinermis*	PK	0,299	2	1,8	1,6	1	N50.02215	E15.33557	206	CZE
	U0447	subsp. *dioica*	PK	0,559	4	1,3	1,5	1	N50.02215	E15.33557	206	CZE
	U0448	subsp. *dioica*	PK	0,564	4	1,1	1,4	1	N50.02215	E15.33557	206	CZE
	U0449	subsp. *dioica*	PK	0,563	4	1,9	1,4	1	N50.02215	E15.33557	206	CZE

ID number of population	ID number of analysis	Taxon	Collector	Relative fluorescence intensity	DNA-ploidy level	CV of standard	CV of sample	N. of individuals in analysis	Latitude (WGS-84)	Longitude (WGS-84)	Altitude (m a.s.l.)	Country (ISO 3166-1)
	U0450	subsp. *subinermis*	PK	0,295	2	1,2	2,2	1	N50.02215	E15.33557	206	CZE
	U0451	subsp. *dioica*	PK	0,569	4	1,0	1,3	1	N50.02215	E15.33557	206	CZE
	U0452	subsp. *dioica*	PK	0,577	4	1,2	1,5	1	N50.02215	E15.33557	206	CZE
	U0453	subsp. *dioica* triploid	PK	0,419	3	1,7	1,4	1	N50.02215	E15.33557	206	CZE
	U0454	subsp. *dioica*	PK	0,558	4	1,2	1,5	1	N50.02215	E15.33557	206	CZE
	U0455	subsp. *dioica*	PK	0,571	4	1,9	1,5	1	N50.02215	E15.33557	206	CZE
	U0456	subsp. *subinermis*	PK	0,300	2	1,1	1,8	1	N50.02215	E15.33557	206	CZE
	U0457	subsp. *subinermis*	PK	0,297	2	1,2	1,5	1	N50.02215	E15.33557	206	CZE
	U0458	subsp. *dioica*	PK	0,570	4	1,2	1,2	1	N50.02215	E15.33557	206	CZE
	U0459	subsp. *dioica*	PK	0,575	4	1,1	1,3	1	N50.02215	E15.33557	206	CZE
UP0162	U0460	subsp. *dioica*	FK	0,573	4	1,0	1,9	1	N37.92900	E14.64242	1476	ITA
	U0461	subsp. *dioica*	FK	0,570	4	1,3	1,7	1	N37.94089	E14.95978	1156	ITA
UP0164	U0462	subsp. *dioica*	MD	0,571	4	0,7	1,9	1	N48.38822	E20.35841	219	SVK
UP0165	U0463	subsp. *dioica*	JS	0,599	4	0,9	1,8	1	N42.49840	E13.55948	1475	ITA
UP0166	U0464	subsp. *dioica*	JS	0,553	4	0,9	2,2	1	N43.55795	E17.55951	1108	BIH
UP0167	U0465	subsp. *dioica*	JS	0,560	4	0,9	1,4	1	N40.21851	E15.30390	933	ITA
UP0168	U0466	subsp. *dioica*	MD	0,580	4	0,9	1,1	1	N47.64431	E18.65664	158	HUN
UP0169	U0467	subsp. *dioica*	MD	0,587	4	0,9	1,1	1	N48.62273	E18.40494	858	SVK
UP0170	U0468	subsp. *dioica*	MD	0,566	4	0,9	1,8	1	N48.95489	E18.41347	559	SVK
UP0171	U0469	subsp. *dioica*	MD	0,577	4	1,5	3,0	1	N48.34711	E21.83508	95	HUN
UP0172	U0470	subsp. *dioica*	MD	0,572	4	0,8	1,8	1	N48.98817	E20.77507	575	SVK
UP0173	U0471	subsp. *dioica*	MD	0,584	4	0,8	1,2	1	N49.04994	E20.94231	527	SVK
UP0174	U0472	subsp. *dioica*	MD	0,578	4	1,0	2,2	1	N48.75956	E21.24889	217	SVK
UP0175	U0473	subsp. *dioica*	MD	0,577	4	0,7	1,5	1	N48.55978	E21.75992	98	SVK
UP0176	U0474	subsp. *dioica*	MD	0,573	4	0,7	1,4	1	N49.01931	E20.98331	440	SVK
UP0177	U0475	subsp. *dioica*	MD	0,576	4	0,9	1,5	1	N48.23083	E19.94181	215	SVK
UP0178	U0476	subsp. *dioica*	MD	0,567	4	0,8	1,3	1	N46.31056	E7.68744	623	CHE
UP0179	U0477	subsp. *dioica*	MD	0,580	4	1,2	2,1	1	N48.99053	E21.58161	142	SVK
UP0180	U0478	subsp. *dioica*	MD	0,593	4	0,7	1,4	1	N45.70981	E7.24778	624	ITA
UP0181	U0479	subsp. *dioica*	MD	0,584	4	1,0	2,3	1	N48.29758	E20.34151	151	HUN
UP0182	U0480	subsp. *dioica*	MD	0,603	4	1,5	3,5	1	N48.74836	E21.25531	213	SVK
	U3430	subsp. *dioica*	MD	0,565	4	0,7	1,6	1	N48.74836	E21.25531	214	SVK
UP0183	U0481	subsp. *dioica*	MD	0,586	4	1,6	1,3	1	N48.37356	E19.89053	199	SVK
UP0184	U0482	subsp. *dioica*	MD	0,574	4	0,7	2,2	1	N48.62754	E20.50255	258	SVK
UP0185	U0483	subsp. *subinermis*	MD	0,301	2	0,8	2,4	1	N48.56439	E21.92725	101	SVK
UP0186	U0484	subsp. *subinermis*	MD	0,308	2	1,0	1,7	1	N48.49103	E21.84189	99	SVK
UP0187	U0485	subsp. *subinermis*	MD	0,303	2	0,9	2,3	1	N46.16592	E14.68781	327	SVN
UP0188	U0486	subsp. *dioica*	MD	0,566	4	1,3	2,0	1	N48.43319	E19.59025	225	SVK
UP0189	U0487	subsp. *dioica*	JS	0,565	4	0,8	1,6	1	N48.43206	E21.98053	99	SVK
UP0190	U0488	subsp. *dioica*	MD	0,566	4	0,8	1,6	1	N48.24692	E20.07567	190	SVK
UP0191	U0489	subsp. *dioica*	MD	0,580	4	0,9	2,2	1	N48.39789	E20.24789	181	SVK

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UP0192	U0490	subsp. *dioica*	MD	0,563	4	0,7	1,6	1	N49.04611	E20.94158	517	SVK
UP0193	U0491	subsp. *dioica*	MD	0,571	4	1,0	2,3	1	N49.05328	E21.51717	166	SVK
UP0194	U0492	subsp. *dioica*	MD	0,580	4	0,7	1,5	1	N48.32500	E20.27417	172	SVK
UP0195	U0493	subsp. *dioica*	FK	0,574	4	0,9	1,9	4	N61.63853	E8.05066	952	NOR
	U0494	subsp. *dioica*	FK	0,574	4	0,9	1,9	4	N61.63853	E8.05066	952	NOR
	U0495	subsp. *dioica*	FK	0,574	4	0,9	1,9	4	N61.63853	E8.05066	952	NOR
UP0196	U0498	subsp. *dioica*	KK	0,573	4	1,4	1,3	1	N53.57794	W6.61408	139	IRL
	U0499	subsp. *dioica*	KK	0,590	4	1,3	1,0	1	N53.57794	W6.61408	139	IRL
UP0197	U0500	subsp. *dioica*	KK	0,581	4	0,9	1,1	1	N53.64978	W9.88042	7	IRL
	U0501	subsp. *dioica*	KK	0,579	4	0,5	1,0	1	N53.64978	W9.88042	7	IRL
UP0198	U0502	subsp. *dioica*	KK	0,576	4	1,2	1,8	2	N52.61472	W9.38231	2	IRL
	U0503	subsp. *dioica*	KK	0,576	4	1,2	1,8	2	N52.61472	W9.38231	2	IRL
UP0199	U0504	subsp. *dioica*	KK	0,580	4	0,7	1,3	2	N53.14589	W9.27217	18	IRL
	U0505	subsp. *dioica*	KK	0,580	4	0,7	1,3	2	N53.14589	W9.27217	18	IRL
UP0200	U0506	subsp. *dioica*	PT, ZC	0,562	4	1,1	1,5	1	N37.98109	E15.14355	1021	ITA
	U3476	subsp. *dioica*	PT, ZC	0,569	4	1,2	1,7	1	N37.98109	E15.14355	1021	ITA
	U3477	subsp. *dioica*	PT, ZC	0,571	4	1,6	2,0	1	N37.98109	E15.14355	1021	ITA
	U3478	subsp. *dioica*	PT, ZC	0,564	4	1,2	1,8	1	N37.98109	E15.14355	1021	ITA
	U3479	subsp. *dioica*	PT, ZC	0,568	4	1,4	1,7	1	N37.98109	E15.14355	1021	ITA
	U3480	subsp. *dioica*	PT, ZC	0,569	4	1,3	1,5	1	N37.98109	E15.14355	1021	ITA
UP0201	U0509	subsp. *dioica*	PT, ZC	0,577	4	1,4	1,4	1	N37.85794	E13.38822	1130	ITA
	U3481	subsp. *dioica*	PT, ZC	0,574	4	1,2	1,6	1	N37.85794	E13.38822	1130	ITA
	U3482	subsp. *dioica*	PT, ZC	0,580	4	1,2	1,6	1	N37.85794	E13.38822	1130	ITA
	U3483	subsp. *dioica*	PT, ZC	0,577	4	1,0	1,4	1	N37.85794	E13.38822	1130	ITA
	U3484	subsp. *dioica*	PT, ZC	0,580	4	1,6	1,8	1	N37.85794	E13.38822	1130	ITA
	U3485	subsp. *dioica*	PT, ZC	0,572	4	1,3	1,8	1	N37.85794	E13.38822	1130	ITA
UP0202	U0511	subsp. *dioica*	PT, ZC	0,572	4	1,2	1,7	1	N37.91019	E13.99032	860	ITA
	U0512	subsp. *dioica*	PT, ZC	0,568	4	1,1	1,7	1	N37.91019	E13.99032	860	ITA
	U0513	subsp. *dioica*	PT, ZC	0,575	4	1,3	1,7	1	N37.91019	E13.99032	860	ITA
	U0514	subsp. *dioica*	PT, ZC	0,576	4	1,3	1,9	1	N37.91019	E13.99032	860	ITA
	U0515	subsp. *dioica*	PT, ZC	0,576	4	1,2	1,9	1	N37.91019	E13.99032	860	ITA
	U0516	subsp. *dioica*	PT, ZC	0,575	4	1,5	2,0	1	N37.91019	E13.99032	860	ITA
UP0203	U0551	subsp. *dioica*	TU	0,619	4	1,7	3,2	1	N40.10269	E29.12839	1928	TUR
	U0553	subsp. *dioica*	TU	0,598	4	0,8	2,6	1	N40.10269	E29.12839	1928	TUR
	U0554	subsp. *dioica*	TU	0,593	4	1,5	2,5	1	N40.10269	E29.12839	1928	TUR
UP0204	U0559	subsp. *dioica*	TU	0,623	4	1,2	4,4	1	N40.10264	E29.12814	1930	TUR
	U0560	subsp. *dioica*	TU	0,601	4	1,7	2,2	1	N40.10264	E29.12814	1930	TUR
	U0561	subsp. *dioica*	TU	0,581	4	1,2	2,8	1	N40.10264	E29.12814	1930	TUR
UP0205	U0568	subsp. *dioica*	TU	0,602	4	1,4	2,1	1	N43.27950	E22.06336	326	SRB
	U0568	subsp. *dioica*	TU	0,616	4	1,5	3,0	1	N43.27950	E22.06336	326	SRB
	U0569	subsp. *dioica*	TU	0,591	4	0,9	3,9	1	N43.27950	E22.06336	326	SRB

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	U0570	subsp. *dioica*	TU	0,595	4	1,2	2,0	1	N43.27950	E22.06336	326	SRB
	U0570	subsp. *dioica*	TU	0,623	4	1,3	2,8	1	N43.27950	E22.06336	326	SRB
	U0572	subsp. *dioica*	TU	0,589	4	1,3	2,0	1	N43.27950	E22.06336	326	SRB
	U0574	subsp. *dioica*	TU	0,607	4	1,4	3,5	1	N43.27950	E22.06336	326	SRB
UP0206	U0575	subsp. *dioica*	LR	0,579	4	1,2	2,4	1	N52.40698	E13.05818	34	DEU
	U1402	subsp. *dioica*	LR	0,571	4	0,8	2,5	1	N52.40698	E13.05818	34	DEU
	U3102	subsp. *dioica*	LR	0,599	4	1,4	1,9	1	N52.40698	E13.05818	34	DEU
UP0207	U0577	subsp. *dioica*	LR	0,611	4	0,8	2,4	1	N56.94440	E24.12362	12	LVA
	U1403	subsp. *dioica*	LR	0,628	4	1,1	4,9	1	N56.94440	E24.12362	12	LVA
	U1404	subsp. *dioica*	LR	0,625	4	1,2	4,3	1	N56.94440	E24.12362	12	LVA
	U1405	subsp. *dioica*	LR	0,637	4	1,9	2,9	1	N56.94440	E24.12362	12	LVA
UP0208	U0578	subsp. *dioica*	LR	0,560	4	1,1	1,7	1	N56.99637	E23.92158	12	LVA
UP0209	U0579	subsp. *dioica*	LR	0,578	4	1,2	2,8	1	N57.16542	E24.84953	90	LVA
	U0580	subsp. *dioica*	LR	0,592	4	1,3	3,4	1	N57.16542	E24.84953	90	LVA
	U1417	subsp. *dioica*	LR	0,593	4	0,9	2,5	1	N57.16542	E24.84953	90	LVA
UP0210	U0581	subsp. *dioica*	LR	0,568	4	0,8	2,7	1	N57.17635	E24.84768	23	LVA
	U0582	subsp. *dioica*	LR	0,596	4	1,4	3,9	1	N57.17635	E24.84768	23	LVA
	U0583	subsp. *dioica*	LR	0,582	4	1,0	2,7	1	N57.17635	E24.84768	23	LVA
	U1418	subsp. *dioica*	LR	0,550	4	0,9	1,4	1	N57.17635	E24.84768	23	LVA
	U1419	subsp. *dioica*	LR	0,578	4	0,9	3,7	1	N57.17635	E24.84768	23	LVA
UP0211	U0584	subsp. *subinermis*	LR	0,319	2	0,8	2,1	1	N56.65638	E23.73452	3	LVA
	U0585	subsp. *subinermis*	LR	0,315	2	0,7	2,4	1	N56.65638	E23.73452	3	LVA
	U0586	subsp. *subinermis*	LR	0,311	2	0,9	2,8	1	N56.65638	E23.73452	3	LVA
	U0587	subsp. *dioica*	LR	0,567	4	0,9	1,7	1	N56.65638	E23.73452	3	LVA
UP0212	U0588	subsp. *dioica*	LR	0,591	4	1,2	2,8	1	N56.62198	E23.27367	42	LVA
	U1423	subsp. *dioica*	LR	0,586	4	1,1	3,9	1	N56.62198	E23.27367	42	LVA
	U1424	subsp. *dioica*	LR	0,569	4	0,8	1,6	1	N56.62198	E23.27367	42	LVA
	U1425	subsp. *dioica*	LR	0,595	4	2,3	3,4	1	N56.62198	E23.27367	42	LVA
UP0213	U0589	subsp. *dioica*	LR	0,587	4	1,3	2,3	1	N56.40147	E24.17733	14	LVA
	U1432	subsp. *subinermis*	LR	0,307	2	1,8	3,5	1	N56.40147	E24.17733	14	LVA
	U1433	subsp. *subinermis*	LR	0,315	2	1,4	4,5	1	N56.40147	E24.17733	14	LVA
UP0214	U0590	subsp. *dioica*	LR	0,581	4	1,0	2,2	1	N56.91195	E23.45655	20	LVA
	U0591	subsp. *dioica*	LR	0,572	4	0,8	1,6	1	N56.91195	E23.45655	20	LVA
	U1434	subsp. *dioica*	LR	0,573	4	0,8	1,8	1	N56.91195	E23.45655	20	LVA
	U1435	subsp. *dioica*	LR	0,583	4	1,3	2,7	1	N56.91195	E23.45655	20	LVA
UP0215	U0592	subsp. *dioica*	LR	0,580	4	1,7	2,9	1	N57.00145	E23.48883	2	LVA
	U1436	subsp. *subinermis*	LR	0,316	2	1,6	4,3	1	N57.00145	E23.48883	2	LVA
UP0216	U0593	subsp. *dioica*	LR	0,593	4	1,5	2,8	1	N56.96787	E21.98196	19	LVA
	U1437	subsp. *dioica*	LR	0,560	4	3,1	2,7	1	N56.96787	E21.98196	19	LVA
	U1438	subsp. *dioica*	LR	0,595	4	1,8	3,5	1	N56.96787	E21.98196	19	LVA
	U1439	subsp. *dioica*	LR	0,592	4	0,8	2,9	1	N56.96787	E21.98196	19	LVA

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	U1440	subsp. *dioica*	LR	0,570	4	1,4	4,3	1	N56.96787	E21.98196	19	LVA
	U1441	subsp. *dioica*	LR	0,623	4	2,6	4,7	1	N56.96787	E21.98196	19	LVA
UP0217	U0594	subsp. *subinermis*	LR	0,299	2	1,1	2,4	1	N56.95191	E23.51314	11	LVA
	U0595	subsp. *subinermis*	LR	0,303	2	1,5	2,3	1	N56.95191	E23.51314	11	LVA
	U0596	subsp. *subinermis*	LR	0,300	2	1,3	3,4	1	N56.95191	E23.51314	11	LVA
	U0597	subsp. *subinermis*	LR	0,304	2	0,9	3,2	1	N56.95191	E23.51314	11	LVA
	U0598	subsp. *subinermis*	LR	0,296	2	1,5	2,9	1	N56.95191	E23.51314	11	LVA
	U0599	subsp. *subinermis*	LR	0,303	2	0,9	2,8	1	N56.95191	E23.51314	11	LVA
	U0600	subsp. *subinermis*	LR	0,308	2	0,8	2,5	1	N56.95191	E23.51314	11	LVA
	U1399	subsp. *subinermis*	LR	0,307	2	1,4	3,6	1	N56.95191	E23.51314	11	LVA
	U1400	subsp. *subinermis*	LR	0,303	2	0,9	2,4	1	N56.95191	E23.51314	11	LVA
	U1401	subsp. *subinermis*	LR	0,298	2	1,5	4,0	1	N56.95191	E23.51314	11	LVA
	U2230	subsp. *subinermis*	LR, SS	0,324	2	1,1	3,1	1	N56.95191	E23.51314	2	LVA
	U2231	subsp. *subinermis*	LR, SS	0,314	2	1,0	3,4	1	N56.95191	E23.51314	2	LVA
	U2232	subsp. *subinermis*	LR, SS	0,321	2	0,9	4,4	1	N56.95191	E23.51314	2	LVA
	U2233	subsp. *subinermis*	LR, SS	0,324	2	1,4	4,8	1	N56.95191	E23.51314	2	LVA
	U2234	subsp. *subinermis*	LR, SS	0,304	2	0,9	3,9	1	N56.95191	E23.51314	2	LVA
	U2287	subsp. *subinermis*	LR, SS	0,307	2	0,7	1,9	1	N56.95191	E23.51314	2	LVA
UP0218	U0607	subsp. *dioica*	LR	0,557	4	1,5	1,8	1	N49.35188	E14.14547	355	CZE
	U0608	subsp. *subinermis*	LR	0,290	2	1,8	3,4	1	N49.35188	E14.14547	355	CZE
	U0609	subsp. *dioica*	LR	0,567	4	1,7	1,9	1	N49.35188	E14.14547	355	CZE
	U0610	subsp. *dioica*	LR	0,557	4	1,3	1,7	1	N49.35188	E14.14547	355	CZE
	U1632	subsp. *subinermis*	LR	0,307	2	1,2	3,5	1	N49.35188	E14.14547	355	CZE
	U3558	subsp. *dioica*	LR	0,571	4	0,9	2,8	1	N49.35188	E14.14547	354	CZE
	U3559	subsp. *subinermis*	LR	0,303	2	0,8	1,8	1	N49.35188	E14.14547	354	CZE
UP0219	U0611	subsp. *subinermis*	LR	0,308	2	0,9	2,5	1	N48.64450	E16.93106	151	CZE
	U0612	subsp. *subinermis*	LR	0,310	2	0,7	2,1	1	N48.64450	E16.93106	151	CZE
	U0613	subsp. *subinermis*	LR	0,309	2	0,9	3,8	1	N48.64450	E16.93106	151	CZE
	U1339	subsp. *subinermis*	LR	0,316	2	1,0	2,7	1	N48.64450	E16.93106	151	CZE
UP0220	U0614	subsp. *subinermis*	LR	0,308	2	0,8	2,4	1	N48.63342	E16.93131	150	CZE
	U0615	subsp. *subinermis*	LR	0,314	2	0,8	2,6	1	N48.63342	E16.93131	150	CZE
	U0616	subsp. *subinermis*	LR	0,305	2	0,9	2,4	1	N48.63342	E16.93131	150	CZE
	U1338	subsp. *subinermis*	LR	0,303	2	0,9	3,4	1	N48.63342	E16.93131	150	CZE
UP0221	U0617	subsp. *dioica*	LR	0,568	4	1,1	2,0	1	N48.66231	E16.96006	156	CZE
	U0618	subsp. *dioica*	LR	0,579	4	1,8	3,5	1	N48.66231	E16.96006	156	CZE
UP0222	U0621	subsp. *dioica*	JC	0,573	4	1,5	2,7	1	N38.89164	E21.87532	1116	GRC
	U0622	subsp. *dioica*	JC	0,575	4	1,3	2,3	1	N38.89164	E21.87532	1116	GRC
	U0623	subsp. *dioica*	JC	0,576	4	1,3	2,5	1	N38.89164	E21.87532	1116	GRC
UP0223	U0624	subsp. *dioica*	JC	0,572	4	1,2	2,4	1	N40.05764	E21.08280	1773	GRC
	U0625	subsp. *dioica*	JC	0,593	4	1,4	2,3	1	N40.05764	E21.08280	1773	GRC
UP0224	U0626	subsp. *dioica*	JC	0,583	4	1,4	1,6	1	N39.40366	E21.20857	1353	GRC

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	U0627	subsp. *dioica*	JC	0,582	4	1,2	2,6	1	N39.40366	E21.20857	1353	GRC
UP0225	U0629	subsp. *dioica*	JC	0,575	4	1,3	2,4	1	N40.91141	E24.14438	1259	GRC
UP0226	U0630	subsp. *dioica*	FK	0,590	4	1,3	1,8	1	N55.05460	E12.22547	1	DNK
	U0631	subsp. *dioica*	FK	0,588	4	1,2	2,3	1	N55.05460	E12.22547	1	DNK
	U0632	subsp. *dioica*	FK	0,610	4	1,3	2,8	1	N55.05460	E12.22547	1	DNK
	U0633	subsp. *dioica*	FK	0,619	4	1,4	3,0	1	N55.05460	E12.22547	1	DNK
	U0634	subsp. *dioica*	FK	0,603	4	1,4	3,3	1	N55.05460	E12.22547	1	DNK
UP0227	U0635	subsp. *dioica*	LR	0,603	4	1,5	4,3	1	N49.50166	E14.16706	437	CZE
UP0228	U0636a	subsp. *dioica*	LR	0,599	4	1,2	3,0	1	N49.51617	E14.02895	436	CZE
	U0636b	subsp. *dioica* aneuploid	LR	0,515	–	1,1	3,5	1	N49.51617	E14.02895	436	CZE
	U1621	subsp. *dioica*	LR	0,562	4	1,2	1,5	1	N49.51617	E14.02895	440	CZE
	U3593	subsp. *dioica* aneuploid	LR	0,493	–	0,8	1,6	1	N49.51617	E14.02895	440	CZE
	U3594	subsp. *dioica* aneuploid	LR	0,492	–	0,7	1,6	1	N49.51617	E14.02895	440	CZE
UP0229	U0637	subsp. *dioica* aneuploid	LR	0,511	–	1,2	2,5	1	N49.51559	E14.17692	385	CZE
UP0230	U0638	subsp. *dioica*	LR	0,593	4	1,5	3,3	1	N49.50997	E14.16918	403	CZE
UP0231	U0640	subsp. *dioica*	LR	0,597	4	1,5	2,8	1	N49.51100	E14.16913	388	CZE
UP0232	U0641	subsp. *dioica*	LR	0,577	4	1,2	2,5	1	N49.51172	E14.16955	367	CZE
UP0233	U0647	subsp. *dioica*	LR	0,561	4	1,4	2,2	2	N50.44772	E14.16108	158	CZE
	U0648	subsp. *dioica*	LR	0,561	4	1,4	2,2	2	N50.44772	E14.16108	158	CZE
UP0234	U0649	subsp. *dioica*	LR	0,571	4	1,2	1,9	4	N49.32331	E14.70072	401	CZE
	U0650	subsp. *dioica*	LR	0,571	4	1,2	1,9	4	N49.32331	E14.70072	401	CZE
	U0651	subsp. *dioica*	LR	0,571	4	1,2	1,9	4	N49.32331	E14.70072	401	CZE
	U0652	subsp. *dioica*	LR	0,571	4	1,2	1,9	4	N49.32331	E14.70072	401	CZE
UP0235	U0653	subsp. *dioica*	LR	0,555	4	1,5	2,3	3	N50.39789	E14.08228	168	CZE
	U0654	subsp. *dioica*	LR	0,555	4	1,5	2,3	3	N50.39789	E14.08228	168	CZE
	U0655	subsp. *dioica*	LR	0,555	4	1,5	2,3	3	N50.39789	E14.08228	168	CZE
UP0236	U0656	subsp. *subinermis*	LR	0,297	2	1,8	2,6	1	N50.42700	E14.14594	164	CZE
	U0657	subsp. *subinermis*	LR	0,298	2	1,5	3,4	1	N50.42700	E14.14594	164	CZE
UP0237	U0658	subsp. *dioica*	LR	0,603	4	1,2	2,7	1	N49.21056	E13.50467	493	CZE
	U0659	subsp. *dioica*	LR	0,624	4	1,3	3,9	1	N49.21056	E13.50467	493	CZE
	U0660	subsp. *dioica*	LR	0,578	4	1,2	3,9	1	N49.21056	E13.50467	493	CZE
	U0661	subsp. *dioica*	LR	0,619	4	1,1	1,3	1	N49.21056	E13.50467	493	CZE
UP0238	U0662	subsp. *dioica*	LR	0,573	4	1,5	2,2	3	N49.32142	E14.70525	404	CZE
	U0663	subsp. *dioica*	LR	0,573	4	1,5	2,2	3	N49.32142	E14.70525	404	CZE
	U0664	subsp. *dioica*	LR	0,573	4	1,5	2,2	3	N49.32142	E14.70525	404	CZE
UP0239	U0665	subsp. *dioica*	LR	0,584	4	1,5	1,7	3	N49.32136	E14.70553	404	CZE
	U0666	subsp. *dioica*	LR	0,584	4	1,5	1,7	3	N49.32136	E14.70553	404	CZE
	U0667	subsp. *dioica*	LR	0,584	4	1,5	1,7	3	N49.32136	E14.70553	404	CZE
UP0240	U0668	subsp. *dioica*	LR	0,572	4	1,4	2,6	2	N50.39733	E14.08528	170	CZE
	U0669	subsp. *dioica*	LR	0,572	4	1,4	2,6	2	N50.39733	E14.08528	170	CZE
UP0241	U0670	subsp. *dioica*	LR	0,576	4	1,3	2,8	4	N50.45239	E14.16394	167	CZE

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	U0671	subsp. *dioica*	LR	0,576	4	1,3	2,8	4	N50.45239	E14.16394	167	CZE
	U0672	subsp. *dioica*	LR	0,576	4	1,3	2,8	4	N50.45239	E14.16394	167	CZE
	U0673	subsp. *dioica*	LR	0,576	4	1,3	2,8	4	N50.45239	E14.16394	167	CZE
UP0242	U0674	subsp. *dioica*	LR	0,564	4	1,2	2,0	4	N50.45181	E14.15969	160	CZE
	U0675	subsp. *dioica*	LR	0,564	4	1,2	2,0	4	N50.45181	E14.15969	160	CZE
	U0676	subsp. *dioica*	LR	0,564	4	1,2	2,0	4	N50.45181	E14.15969	160	CZE
	U0677	subsp. *dioica*	LR	0,564	4	1,2	2,0	4	N50.45181	E14.15969	160	CZE
UP0243	U0678	subsp. *dioica*	LR	0,569	4	1,4	2,5	3	N49.37944	E14.14217	426	CZE
	U0679	subsp. *dioica*	LR	0,569	4	1,4	2,5	3	N49.37944	E14.14217	426	CZE
	U0680	subsp. *dioica*	LR	0,569	4	1,4	2,5	3	N49.37944	E14.14217	426	CZE
UP0244	U0681	subsp. *dioica*	LR	0,556	4	1,2	1,9	5	N49.21192	E13.50492	498	CZE
	U0682	subsp. *dioica*	LR	0,556	4	1,2	1,9	5	N49.21192	E13.50492	498	CZE
	U0683	subsp. *dioica*	LR	0,556	4	1,2	1,9	5	N49.21192	E13.50492	498	CZE
	U0684	subsp. *dioica*	LR	0,556	4	1,2	1,9	5	N49.21192	E13.50492	498	CZE
UP0245	U0685	subsp. *dioica*	LR	0,566	4	1,3	1,8	1	N49.37989	E14.14444	415	CZE
	U0686	subsp. *dioica*	LR	0,581	4	1,1	1,8	1	N49.37989	E14.14444	415	CZE
	U0687	subsp. *dioica*	LR	0,557	4	1,2	1,6	1	N49.37989	E14.14444	415	CZE
UP0246	U0688	subsp. *dioica*	LR	0,572	4	1,1	1,9	4	N49.26539	E13.58014	511	CZE
	U0689	subsp. *dioica*	LR	0,572	4	1,1	1,9	4	N49.26539	E13.58014	511	CZE
	U0690	subsp. *dioica*	LR	0,572	4	1,1	1,9	4	N49.26539	E13.58014	511	CZE
	U0691	subsp. *dioica*	LR	0,572	4	1,1	1,9	4	N49.26539	E13.58014	511	CZE
UP0247	U0692	subsp. *dioica*	LR	0,581	4	1,4	2,3	2	N50.19203	E14.67086	172	CZE
	U0693	subsp. *dioica*	LR	0,581	4	1,4	2,3	2	N50.19203	E14.67086	172	CZE
UP0248	U0694	subsp. *dioica*	LR	0,569	4	1,3	1,9	4	N49.37900	E14.14022	438	CZE
	U0695	subsp. *dioica*	LR	0,569	4	1,3	1,9	4	N49.37900	E14.14022	438	CZE
	U0696	subsp. *dioica*	LR	0,569	4	1,3	1,9	4	N49.37900	E14.14022	438	CZE
	U0697	subsp. *dioica*	LR	0,569	4	1,3	1,9	4	N49.37900	E14.14022	438	CZE
UP0249	U0698	subsp. *dioica*	LR	0,559	4	1,4	1,8	2	N50.00110	E14.44140	254	CZE
	U0699	subsp. *dioica*	LR	0,559	4	1,4	1,8	2	N50.00110	E14.44140	254	CZE
UP0250	U0700	subsp. *dioica*	LR	0,544	4	1,4	2,0	6	N49.25972	E13.94703	387	CZE
	U0701	subsp. *dioica*	LR	0,544	4	1,4	2,0	6	N49.25972	E13.94703	387	CZE
	U0702	subsp. *dioica*	LR	0,544	4	1,4	2,0	6	N49.25972	E13.94703	387	CZE
	U0703	subsp. *dioica*	LR	0,544	4	1,4	2,0	6	N49.25972	E13.94703	387	CZE
	U0704	subsp. *dioica*	LR	0,544	4	1,4	2,0	6	N49.25972	E13.94703	387	CZE
	U0705	subsp. *dioica*	LR	0,544	4	1,4	2,0	6	N49.25972	E13.94703	387	CZE
UP0251	U0706	subsp. *dioica*	LR	0,563	4	1,4	2,2	6	N49.21244	E13.50589	498	CZE
	U0707	subsp. *dioica*	LR	0,563	4	1,4	2,2	6	N49.21244	E13.50589	498	CZE
	U0708	subsp. *dioica*	LR	0,563	4	1,4	2,2	6	N49.21244	E13.50589	498	CZE
	U0709	subsp. *dioica*	LR	0,563	4	1,4	2,2	6	N49.21244	E13.50589	498	CZE
	U0710	subsp. *dioica*	LR	0,563	4	1,4	2,2	6	N49.21244	E13.50589	498	CZE
	U0711	subsp. *dioica*	LR	0,563	4	1,4	2,2	6	N49.21244	E13.50589	498	CZE

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UP0252	U0712	subsp. *dioica*	LR	0,576	4	1,7	2,4	3	N50.19222	E14.67117	171	CZE
	U0713	subsp. *dioica*	LR	0,576	4	1,7	2,4	3	N50.19222	E14.67117	171	CZE
	U0714	subsp. *dioica*	LR	0,576	4	1,7	2,4	3	N50.19222	E14.67117	171	CZE
UP0253	U0715	subsp. *dioica*	LR	0,565	4	1,6	2,2	6	N49.81252	E14.32170	285	CZE
	U0716	subsp. *dioica*	LR	0,565	4	1,6	2,2	6	N49.81252	E14.32170	285	CZE
	U0717	subsp. *dioica*	LR	0,565	4	1,6	2,2	6	N49.81252	E14.32170	285	CZE
	U0718	subsp. *dioica*	LR	0,565	4	1,6	2,2	6	N49.81252	E14.32170	285	CZE
	U0719	subsp. *dioica*	LR	0,565	4	1,6	2,2	6	N49.81252	E14.32170	285	CZE
	U0720	subsp. *dioica*	LR	0,565	4	1,6	2,2	6	N49.81252	E14.32170	285	CZE
UP0254	U0725	subsp. *dioica*	LR	0,567	4	1,2	1,9	3	N50.32378	E14.47419	164	CZE
	U0726	subsp. *dioica*	LR	0,567	4	1,2	1,9	3	N50.32378	E14.47419	164	CZE
	U0727	subsp. *dioica*	LR	0,567	4	1,2	1,9	3	N50.32378	E14.47419	164	CZE
UP0255	U0728	subsp. *dioica*	LR	0,543	4	2,9	2,1	1	N49.28494	E14.69825	398	CZE
UP0256	U0729	subsp. *dioica*	LR	0,564	4	1,2	1,9	2	N49.23392	E14.71339	402	CZE
	U0730	subsp. *dioica*	LR	0,564	4	1,2	1,9	2	N49.23392	E14.71339	402	CZE
UP0257	U0731	subsp. *dioica*	LR	0,561	4	1,4	2,1	4	N50.42769	E14.14625	165	CZE
	U0732	subsp. *dioica*	LR	0,561	4	1,4	2,1	4	N50.42769	E14.14625	165	CZE
	U0733	subsp. *dioica*	LR	0,561	4	1,4	2,1	4	N50.42769	E14.14625	165	CZE
	U0734	subsp. *dioica*	LR	0,561	4	1,4	2,1	4	N50.42769	E14.14625	165	CZE
UP0258	U0739	subsp. *dioica*	LR	0,567	4	1,3	2,2	3	N50.44908	E14.16089	164	CZE
	U0740	subsp. *dioica*	LR	0,567	4	1,3	2,2	3	N50.44908	E14.16089	164	CZE
	U0741	subsp. *dioica*	LR	0,567	4	1,3	2,2	3	N50.44908	E14.16089	164	CZE
UP0259	U0742	subsp. *dioica*	LR	0,583	4	1,1	1,9	1	N50.44933	E14.16033	165	CZE
UP0260	U0743	subsp. *dioica*	LR	0,558	4	1,4	2,6	5	N50.25561	E14.54397	181	CZE
	U0744	subsp. *dioica*	LR	0,558	4	1,4	2,6	5	N50.25561	E14.54397	181	CZE
	U0745	subsp. *dioica*	LR	0,558	4	1,4	2,6	5	N50.25561	E14.54397	181	CZE
	U0746	subsp. *dioica*	LR	0,558	4	1,4	2,6	5	N50.25561	E14.54397	181	CZE
	U0747	subsp. *dioica*	LR	0,558	4	1,4	2,6	5	N50.25561	E14.54397	181	CZE
UP0261	U0748	subsp. *dioica*	LR	0,581	4	1,3	1,8	3	N49.32194	E14.70639	409	CZE
	U0749	subsp. *dioica*	LR	0,581	4	1,3	1,8	3	N49.32194	E14.70639	409	CZE
	U0750	subsp. *dioica*	LR	0,581	4	1,3	1,8	3	N49.32194	E14.70639	409	CZE
UP0262	U0751	subsp. *dioica*	LR	0,562	4	1,4	2,3	1	N48.80530	E16.64211	364	CZE
UP0263	U0752	subsp. *dioica*	LR	0,562	4	1,4	2,0	2	N49.03861	E14.80639	426	CZE
	U0753	subsp. *dioica*	LR	0,562	4	1,4	2,0	2	N49.03861	E14.80639	426	CZE
UP0264	U0754	subsp. *dioica*	LR	0,563	4	1,1	1,9	2	N49.23344	E14.71922	404	CZE
	U0755	subsp. *dioica*	LR	0,563	4	1,1	1,9	2	N49.23344	E14.71922	404	CZE
UP0265	U0756	subsp. *dioica*	LR	0,562	4	1,7	1,8	3	N49.28400	E14.70047	399	CZE
	U0757	subsp. *dioica*	LR	0,562	4	1,7	1,8	3	N49.28400	E14.70047	399	CZE
	U0758	subsp. *dioica*	LR	0,562	4	1,7	1,8	3	N49.28400	E14.70047	399	CZE
UP0266	U0759	subsp. *dioica*	LR	0,564	4	1,9	2,1	3	N49.03794	E14.80583	432	CZE
	U0760	subsp. *dioica*	LR	0,564	4	1,9	2,1	3	N49.03794	E14.80583	432	CZE

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	U0761	subsp. *dioica*	LR	0,564	4	1,9	2,1	3	N49.03794	E14.80583	432	CZE
UP0267	U0762	subsp. *dioica*	LR	0,569	4	1,0	2,1	4	N50.45183	E14.15956	160	CZE
	U0763	subsp. *dioica*	LR	0,569	4	1,0	2,1	4	N50.45183	E14.15956	160	CZE
	U0764	subsp. *dioica*	LR	0,569	4	1,0	2,1	4	N50.45183	E14.15956	160	CZE
	U0765	subsp. *dioica*	LR	0,569	4	1,0	2,1	4	N50.45183	E14.15956	160	CZE
UP0268	U0766	subsp. *dioica*	LR	0,571	4	1,2	2,1	3	N49.26003	E13.94394	389	CZE
	U0767	subsp. *dioica*	LR	0,571	4	1,2	2,1	3	N49.26003	E13.94394	389	CZE
	U0768	subsp. *dioica*	LR	0,571	4	1,2	2,1	3	N49.26003	E13.94394	389	CZE
UP0269	U0769	subsp. *dioica*	LR	0,567	4	1,1	2,4	4	N49.26011	E13.94556	385	CZE
	U0770	subsp. *dioica*	LR	0,567	4	1,1	2,4	4	N49.26011	E13.94556	385	CZE
	U0771	subsp. *dioica*	LR	0,567	4	1,1	2,4	4	N49.26011	E13.94556	385	CZE
	U0772	subsp. *dioica*	LR	0,567	4	1,1	2,4	4	N49.26011	E13.94556	385	CZE
UP0270	U0773	subsp. *dioica*	LR	0,574	4	1,5	2,6	3	N50.39744	E14.08536	170	CZE
	U0774	subsp. *dioica*	LR	0,574	4	1,5	2,6	3	N50.39744	E14.08536	170	CZE
	U0775	subsp. *dioica*	LR	0,574	4	1,5	2,6	3	N50.39744	E14.08536	170	CZE
UP0271	U0776	subsp. *dioica*	LR	0,567	4	1,8	2,2	1	N50.42703	E14.14703	162	CZE
	U0777	subsp. *subinermis*	LR	0,293	2	1,2	3,1	1	N50.42703	E14.14703	162	CZE
UP0272	U0778	subsp. *dioica*	LR	0,576	4	1,7	2,3	3	N49.28417	E14.70069	399	CZE
	U0779	subsp. *dioica*	LR	0,576	4	1,7	2,3	3	N49.28417	E14.70069	399	CZE
	U0780	subsp. *dioica*	LR	0,576	4	1,7	2,3	3	N49.28417	E14.70069	399	CZE
UP0273	U0781	subsp. *dioica*	LR	0,578	4	1,7	2,6	3	N49.32139	E14.70381	403	CZE
	U0782	subsp. *dioica*	LR	0,578	4	1,7	2,6	3	N49.32139	E14.70381	403	CZE
	U0783	subsp. *dioica*	LR	0,578	4	1,7	2,6	3	N49.32139	E14.70381	403	CZE
UP0274	U0784	subsp. *dioica*	LR	0,573	4	1,8	2,1	2	N49.28564	E14.69819	400	CZE
	U0785	subsp. *dioica*	LR	0,573	4	1,8	2,1	2	N49.28564	E14.69819	400	CZE
UP0275	U0786	subsp. *dioica*	LR	0,596	4	1,2	2,6	1	N49.03333	E17.44667	175	CZE
	U0787	subsp. *dioica*	LR	0,606	4	1,5	2,7	1	N49.03333	E17.44667	175	CZE
	U0788	subsp. *dioica*	LR	0,619	4	1,5	3,4	1	N49.03333	E17.44667	175	CZE
	U0789	subsp. *dioica*	LR	0,590	4	1,2	2,3	1	N49.03333	E17.44667	175	CZE
UP0276	U0790	subsp. *dioica*	LR	0,569	4	1,2	2,2	8	N50.61189	E13.87884	224	CZE
	U0791	subsp. *dioica*	LR	0,569	4	1,2	2,2	8	N50.61189	E13.87884	224	CZE
	U0792	subsp. *dioica*	LR	0,569	4	1,2	2,2	8	N50.61189	E13.87884	224	CZE
	U0793	subsp. *dioica*	LR	0,569	4	1,2	2,2	8	N50.61189	E13.87884	224	CZE
	U0794	subsp. *dioica*	LR	0,569	4	1,2	2,2	8	N50.61189	E13.87884	224	CZE
	U0795	subsp. *dioica*	LR	0,569	4	1,2	2,2	8	N50.61189	E13.87884	224	CZE
	U0796	subsp. *dioica*	LR	0,569	4	1,2	2,2	8	N50.61189	E13.87884	224	CZE
	U0797	subsp. *dioica*	LR	0,569	4	1,2	2,2	8	N50.61189	E13.87884	224	CZE
UP0277	U0798	subsp. *dioica*	LR	0,565	4	1,7	2,6	3	N50.19172	E14.67044	173	CZE
	U0799	subsp. *dioica*	LR	0,565	4	1,7	2,6	3	N50.19172	E14.67044	173	CZE
	U0800	subsp. *dioica*	LR	0,565	4	1,7	2,6	3	N50.19172	E14.67044	173	CZE
UP0278	U0801	subsp. *dioica*	LR	0,578	4	1,3	1,9	1	N50.19261	E14.66986	170	CZE

ID number of population	ID number of analysis	Taxon	Collector	Relative fluorescence intensity	DNA-ploidy level	CV of standard	CV of sample	N. of individuals in analysis	Latitude (WGS-84)	Longitude (WGS-84)	Altitude (m a.s.l.)	Country (ISO 3166-1)
	U0802	subsp. *dioica*	LR	0,589	4	1,1	1,9	1	N50.19261	E14.66986	170	CZE
	U0803	subsp. *dioica*	LR	0,571	4	1,3	2,1	1	N50.19261	E14.66986	170	CZE
	U0804	subsp. *dioica*	LR	0,582	4	1,4	3,3	1	N50.19261	E14.66986	170	CZE
	U3638	subsp. *dioica*	LR	0,560	4	1,6	2,2	1	N50.19261	E14.66986	170	CZE
UP0279	U0805	subsp. *dioica*	LR	0,573	4	1,4	2,1	2	N50.25914	E14.54375	167	CZE
	U0806	subsp. *dioica*	LR	0,573	4	1,4	2,1	2	N50.25914	E14.54375	167	CZE
UP0280	U0807	subsp. *dioica*	LR	0,552	4	1,4	1,8	1	N50.32214	E14.46925	163	CZE
	U0808	subsp. *dioica*	LR	0,568	4	1,6	2,7	1	N50.32214	E14.46925	163	CZE
UP0281	U0809	subsp. *dioica*	LR	0,569	4	1,7	2,1	2	N50.32278	E14.47306	163	CZE
	U0810	subsp. *dioica*	LR	0,569	4	1,7	2,1	2	N50.32278	E14.47306	163	CZE
UP0282	U0815	subsp. *dioica*	LR	0,574	4	1,7	2,0	3	N50.25797	E14.54425	167	CZE
	U0816	subsp. *dioica*	LR	0,574	4	1,7	2,0	3	N50.25797	E14.54425	167	CZE
	U0817	subsp. *dioica*	LR	0,574	4	1,7	2,0	3	N50.25797	E14.54425	167	CZE
UP0283	U0818	subsp. *dioica*	LR	0,570	4	1,7	2,7	2	N50.25656	E14.54411	177	CZE
	U0819	subsp. *dioica*	LR	0,570	4	1,7	2,7	2	N50.25656	E14.54411	177	CZE
UP0284	U0820	subsp. *dioica*	LR	0,559	4	1,5	2,7	5	N50.44975	E14.16000	166	CZE
	U0821	subsp. *dioica*	LR	0,559	4	1,5	2,7	5	N50.44975	E14.16000	166	CZE
	U0822	subsp. *dioica*	LR	0,559	4	1,5	2,7	5	N50.44975	E14.16000	166	CZE
	U0823	subsp. *dioica*	LR	0,559	4	1,5	2,7	5	N50.44975	E14.16000	166	CZE
	U0824	subsp. *dioica*	LR	0,559	4	1,5	2,7	5	N50.44975	E14.16000	166	CZE
UP0285	U0825	subsp. *dioica*	LR	0,568	4	1,3	1,9	2	N49.26083	E13.94356	387	CZE
	U0826	subsp. *dioica*	LR	0,568	4	1,3	1,9	2	N49.26083	E13.94356	387	CZE
UP0286	U0827	subsp. *dioica*	LR	0,565	4	1,3	2,7	1	N49.26069	E13.94258	388	CZE
	U0828	subsp. *dioica*	LR	0,565	4	1,3	2,7	1	N49.26069	E13.94258	388	CZE
	U0829	subsp. *dioica*	LR	0,565	4	1,3	2,7	1	N49.26069	E13.94258	388	CZE
	U0830	subsp. *dioica*	LR	0,565	4	1,3	2,7	1	N49.26069	E13.94258	388	CZE
UP0287	U0831	subsp. *dioica*	LR	0,560	4	1,6	2,3	1	N50.42717	E14.14592	164	CZE
	U0832	subsp. *subinermis*	LR	0,291	2	2,2	3,4	1	N50.42717	E14.14592	164	CZE
UP0288	U0833	subsp. *dioica*	LR	0,552	4	1,6	2,7	4	N50.18044	E14.78839	190	CZE
	U0834	subsp. *dioica*	LR	0,552	4	1,6	2,7	4	N50.18044	E14.78839	190	CZE
	U0835	subsp. *dioica*	LR	0,552	4	1,6	2,7	4	N50.18044	E14.78839	190	CZE
	U0836	subsp. *dioica*	LR	0,552	4	1,6	2,7	4	N50.18044	E14.78839	190	CZE
UP0289	U0837	subsp. *dioica*	LR	0,568	4	1,3	2,2	5	N49.25442	E13.55300	462	CZE
	U0838	subsp. *dioica*	LR	0,568	4	1,3	2,2	5	N49.25442	E13.55300	462	CZE
	U0839	subsp. *dioica*	LR	0,568	4	1,3	2,2	5	N49.25442	E13.55300	462	CZE
	U0840	subsp. *dioica*	LR	0,568	4	1,3	2,2	5	N49.25442	E13.55300	462	CZE
	U0841	subsp. *dioica*	LR	0,568	4	1,3	2,2	5	N49.25442	E13.55300	462	CZE
UP0290	U0842	subsp. *dioica*	LR	0,570	4	1,7	2,3	3	N49.32131	E14.70600	404	CZE
	U0843	subsp. *dioica*	LR	0,570	4	1,7	2,3	3	N49.32131	E14.70600	404	CZE
	U0844	subsp. *dioica*	LR	0,570	4	1,7	2,3	3	N49.32131	E14.70600	404	CZE
UP0291	U0845	subsp. *dioica*	LR	0,568	4	1,9	2,4	1	N50.44781	E14.16028	157	CZE

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UP0292	U0846	subsp. *dioica*	LR	0,558	4	1,4	2,9	3	N49.21211	E13.50508	498	CZE
	U0847	subsp. *dioica*	LR	0,558	4	1,4	2,9	3	N49.21211	E13.50508	498	CZE
	U0848	subsp. *dioica*	LR	0,558	4	1,4	2,9	3	N49.21211	E13.50508	498	CZE
UP0293	U0849	subsp. *dioica*	HJ	0,574	4	1,8	2,7	6	N50.62975	E13.85302	192	CZE
	U0850	subsp. *dioica*	HJ	0,574	4	1,8	2,7	6	N50.62975	E13.85302	192	CZE
	U0851	subsp. *dioica*	HJ	0,574	4	1,8	2,7	6	N50.62975	E13.85302	192	CZE
	U0852	subsp. *dioica*	HJ	0,574	4	1,8	2,7	6	N50.62975	E13.85302	192	CZE
	U0853	subsp. *dioica*	HJ	0,574	4	1,8	2,7	6	N50.62975	E13.85302	192	CZE
	U0854	subsp. *dioica*	HJ	0,574	4	1,8	2,7	6	N50.62975	E13.85302	192	CZE
	U0877	subsp. *dioica*	HJ	0,576	4	1,4	2,3	5	N50.62975	E13.85302	192	CZE
	U0878	subsp. *dioica*	HJ	0,576	4	1,4	2,3	5	N50.62975	E13.85302	192	CZE
	U0879	subsp. *dioica*	HJ	0,576	4	1,4	2,3	5	N50.62975	E13.85302	192	CZE
	U0880	subsp. *dioica*	HJ	0,576	4	1,4	2,3	5	N50.62975	E13.85302	192	CZE
	U0881	subsp. *dioica*	HJ	0,576	4	1,4	2,3	5	N50.62975	E13.85302	192	CZE
	U0882	subsp. *dioica*	HJ	0,563	4	1,8	1,6	5	N50.62975	E13.85302	192	CZE
	U0883	subsp. *dioica*	HJ	0,563	4	1,8	1,6	5	N50.62975	E13.85302	192	CZE
	U0884	subsp. *dioica*	HJ	0,563	4	1,8	1,6	5	N50.62975	E13.85302	192	CZE
	U0885	subsp. *dioica*	HJ	0,563	4	1,8	1,6	5	N50.62975	E13.85302	192	CZE
	U0886	subsp. *dioica*	HJ	0,563	4	1,8	1,6	5	N50.62975	E13.85302	192	CZE
	U0977	subsp. *dioica*	HJ	0,574	4	1,8	2,7	5	N50.62975	E13.85302	192	CZE
	U0978	subsp. *dioica*	HJ	0,574	4	1,8	2,7	5	N50.62975	E13.85302	192	CZE
	U0979	subsp. *dioica*	HJ	0,574	4	1,8	2,7	5	N50.62975	E13.85302	192	CZE
	U0980	subsp. *dioica*	HJ	0,574	4	1,8	2,7	5	N50.62975	E13.85302	192	CZE
	U0981	subsp. *dioica*	HJ	0,574	4	1,8	2,7	5	N50.62975	E13.85302	192	CZE
UP0294	U0855	subsp. *dioica*	HJ	0,568	4	1,4	1,2	5	N50.50097	E14.04775	157	CZE
	U0856	subsp. *dioica*	HJ	0,568	4	1,4	1,2	5	N50.50097	E14.04775	157	CZE
	U0857	subsp. *dioica*	HJ	0,568	4	1,4	1,2	5	N50.50097	E14.04775	157	CZE
	U0858	subsp. *dioica*	HJ	0,568	4	1,4	1,2	5	N50.50097	E14.04775	157	CZE
	U0859	subsp. *dioica*	HJ	0,568	4	1,4	1,2	5	N50.50097	E14.04775	157	CZE
	U0864	subsp. *dioica*	HJ	0,582	4	1,7	2,9	5	N50.50097	E14.04775	157	CZE
	U0865	subsp. *dioica*	HJ	0,582	4	1,7	2,9	5	N50.50097	E14.04775	157	CZE
	U0866	subsp. *dioica*	HJ	0,582	4	1,7	2,9	5	N50.50097	E14.04775	157	CZE
	U0867	subsp. *dioica*	HJ	0,582	4	1,7	2,9	5	N50.50097	E14.04775	157	CZE
	U0868	subsp. *dioica*	HJ	0,582	4	1,7	2,9	5	N50.50097	E14.04775	157	CZE
UP0295	U0860	subsp. *dioica*	LR	0,573	4	1,7	2,2	4	N50.19272	E14.67150	171	CZE
	U0861	subsp. *dioica*	LR	0,573	4	1,7	2,2	4	N50.19272	E14.67150	171	CZE
	U0862	subsp. *dioica*	LR	0,573	4	1,7	2,2	4	N50.19272	E14.67150	171	CZE
	U0863	subsp. *dioica*	LR	0,573	4	1,7	2,2	4	N50.19272	E14.67150	171	CZE
UP0296	U0869	subsp. *dioica*	LR	0,567	4	1,7	2,1	3	N50.87577	E14.23508	133	DEU
	U0870	subsp. *dioica*	LR	0,567	4	1,7	2,1	3	N50.87577	E14.23508	133	DEU
	U0871	subsp. *dioica*	LR	0,567	4	1,7	2,1	3	N50.87577	E14.23508	133	DEU

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	U0872	subsp. *dioica*	LR	0,580	4	1,3	2,1	3	N50.87577	E14.23508	133	DEU
	U0873	subsp. *dioica*	LR	0,580	4	1,3	2,1	3	N50.87577	E14.23508	133	DEU
	U0874	subsp. *dioica*	LR	0,580	4	1,3	2,1	3	N50.87577	E14.23508	133	DEU
UP0297	U0875	subsp. *dioica*	RB	0,563	4	1,7	2,2	2	N49.93755	E14.30574	201	CZE
	U0876	subsp. *dioica*	RB	0,563	4	1,7	2,2	2	N49.93755	E14.30574	201	CZE
UP0298	U0887	subsp. *dioica*	JR	0,558	4	1,2	1,9	1	N50.11364	E15.16389	198	CZE
UP0299	U0888	subsp. *dioica*	JR	0,560	4	1,4	1,8	1	N50.10243	E15.17509	199	CZE
UP0300	U0889	subsp. *dioica*	JR	0,554	4	1,7	2,2	1	N50.10589	E15.18225	195	CZE
UP0301	U0890	subsp. *dioica*	JR	0,563	4	1,5	1,7	1	N50.09537	E15.17349	194	CZE
UP0302	U0891	subsp. *dioica*	LR	0,560	4	1,4	2,2	4	N50.44778	E14.16078	158	CZE
	U0892	subsp. *dioica*	LR	0,560	4	1,4	2,2	4	N50.44778	E14.16078	158	CZE
	U0893	subsp. *dioica*	LR	0,560	4	1,4	2,2	4	N50.44778	E14.16078	158	CZE
	U0894	subsp. *dioica*	LR	0,560	4	1,4	2,2	4	N50.44778	E14.16078	158	CZE
UP0303	U0895	subsp. *dioica*	LR	0,578	4	1,1	1,8	2	N50.19189	E14.67094	172	CZE
	U0896	subsp. *dioica*	LR	0,578	4	1,1	1,8	2	N50.19189	E14.67094	172	CZE
UP0304	U0897	subsp. *dioica*	LR	0,567	4	1,5	1,7	1	N49.81213	E14.32397	287	CZE
	U0898	subsp. *dioica*	LR	0,578	4	1,8	1,9	1	N49.81213	E14.32397	287	CZE
	U0899	subsp. *dioica*	LR	0,570	4	1,5	2,0	1	N49.81213	E14.32397	287	CZE
	U0900	subsp. *dioica*	LR	0,571	4	1,5	2,3	1	N49.81213	E14.32397	287	CZE
UP0305	U0901	subsp. *dioica*	LR	0,556	4	1,3	1,8	2	N50.44950	E14.16275	161	CZE
	U0902	subsp. *dioica*	LR	0,556	4	1,3	1,8	2	N50.44950	E14.16275	161	CZE
UP0306	U0903	subsp. *dioica*	LR	0,564	4	1,9	2,4	1	N50.45200	E14.16481	169	CZE
UP0307	U0904	subsp. *dioica*	LR	0,573	4	1,5	2,4	4	N49.28392	E14.69950	400	CZE
	U0905	subsp. *dioica*	LR	0,573	4	1,5	2,4	4	N49.28392	E14.69950	400	CZE
	U0906	subsp. *dioica*	LR	0,573	4	1,5	2,4	4	N49.28392	E14.69950	400	CZE
	U0907	subsp. *dioica*	LR	0,573	4	1,5	2,4	4	N49.28392	E14.69950	400	CZE
UP0308	U0914	subsp. *dioica*	LR	0,554	4	1,4	1,9	7	N49.21125	E13.50250	489	CZE
	U0915	subsp. *dioica*	LR	0,554	4	1,4	1,9	7	N49.21125	E13.50250	489	CZE
	U0916	subsp. *dioica*	LR	0,554	4	1,4	1,9	7	N49.21125	E13.50250	489	CZE
	U0917	subsp. *dioica*	LR	0,554	4	1,4	1,9	7	N49.21125	E13.50250	489	CZE
	U0918	subsp. *dioica*	LR	0,554	4	1,4	1,9	7	N49.21125	E13.50250	489	CZE
	U0919	subsp. *dioica*	LR	0,554	4	1,4	1,9	7	N49.21125	E13.50250	489	CZE
	U0920	subsp. *dioica*	LR	0,554	4	1,4	1,9	7	N49.21125	E13.50250	489	CZE
UP0309	U0921	subsp. *dioica*	LR	0,573	4	1,2	1,9	3	N50.42561	E14.14122	166	CZE
	U0922	subsp. *dioica*	LR	0,573	4	1,2	1,9	3	N50.42561	E14.14122	166	CZE
	U0923	subsp. *dioica*	LR	0,573	4	1,2	1,9	3	N50.42561	E14.14122	166	CZE
UP0310	U0924	subsp. *dioica*	LR	0,562	4	1,3	2,0	2	N50.44917	E14.16214	162	CZE
	U0925	subsp. *dioica*	LR	0,562	4	1,3	2,0	2	N50.44917	E14.16214	162	CZE
UP0311	U0926	subsp. *dioica*	LR	0,565	4	1,6	2,3	3	N50.32417	E14.47469	162	CZE
	U0927	subsp. *dioica*	LR	0,565	4	1,6	2,3	3	N50.32417	E14.47469	162	CZE
	U0928	subsp. *dioica*	LR	0,565	4	1,6	2,3	3	N50.32417	E14.47469	162	CZE

ID number of population	ID number of analysis	Taxon	Collector	Relative fluorescence intensity	DNA-ploidy level	CV of standard	CV of sample	N. of individuals in analysis	Latitude (WGS-84)	Longitude (WGS-84)	Altitude (m a.s.l.)	Country (ISO 3166-1)
UP0312	U0929	subsp. *dioica*	LR	0,564	4	1,7	2,6	5	N49.81673	E14.33176	281	CZE
	U0930	subsp. *dioica*	LR	0,564	4	1,7	2,6	5	N49.81673	E14.33176	281	CZE
	U0931	subsp. *dioica*	LR	0,564	4	1,7	2,6	5	N49.81673	E14.33176	281	CZE
	U0932	subsp. *dioica*	LR	0,564	4	1,7	2,6	5	N49.81673	E14.33176	281	CZE
	U0933	subsp. *dioica*	LR	0,564	4	1,7	2,6	5	N49.81673	E14.33176	281	CZE
UP0313	U0934	subsp. *dioica*	LR	0,565	4	1,5	2,4	3	N50.44903	E14.16117	163	CZE
	U0935	subsp. *dioica*	LR	0,565	4	1,5	2,4	3	N50.44903	E14.16117	163	CZE
	U0936	subsp. *dioica*	LR	0,565	4	1,5	2,4	3	N50.44903	E14.16117	163	CZE
UP0314	U0937	subsp. *dioica*	LR	0,576	4	1,2	2,0	3	N50.44781	E14.16047	157	CZE
	U0938	subsp. *dioica*	LR	0,576	4	1,2	2,0	3	N50.44781	E14.16047	157	CZE
	U0939	subsp. *dioica*	LR	0,576	4	1,2	2,0	3	N50.44781	E14.16047	157	CZE
UP0315	U0940	subsp. *dioica*	LR	0,564	4	1,4	1,9	3	N50.45169	E14.16017	161	CZE
	U0941	subsp. *dioica*	LR	0,564	4	1,4	1,9	3	N50.45169	E14.16017	161	CZE
	U0942	subsp. *dioica*	LR	0,564	4	1,4	1,9	3	N50.45169	E14.16017	161	CZE
UP0316	U0943	subsp. *dioica*	LR	0,575	4	1,6	1,9	3	N50.45094	E14.16150	160	CZE
	U0944	subsp. *dioica*	LR	0,575	4	1,6	1,9	3	N50.45094	E14.16150	160	CZE
	U0945	subsp. *dioica*	LR	0,575	4	1,6	1,9	3	N50.45094	E14.16150	160	CZE
UP0317	U0946	subsp. *dioica*	LR	0,563	4	1,4	2,7	3	N50.45022	E14.16006	167	CZE
	U0947	subsp. *dioica*	LR	0,563	4	1,4	2,7	3	N50.45022	E14.16006	167	CZE
	U0948	subsp. *dioica*	LR	0,563	4	1,4	2,7	3	N50.45022	E14.16006	167	CZE
UP0318	U0949	subsp. *dioica*	LR	0,569	4	1,3	1,9	3	N49.21219	E13.50722	500	CZE
	U0950	subsp. *dioica*	LR	0,569	4	1,3	1,9	3	N49.21219	E13.50722	500	CZE
	U0951	subsp. *dioica*	LR	0,569	4	1,3	1,9	3	N49.21219	E13.50722	500	CZE
UP0319	U0952	subsp. *dioica*	LR	0,569	4	1,2	1,8	2	N49.32156	E14.70328	402	CZE
	U0953	subsp. *dioica*	LR	0,569	4	1,2	1,8	2	N49.32156	E14.70328	402	CZE
UP0320	U0954	subsp. *dioica*	LR	0,570	4	1,5	1,9	3	N49.03808	E14.80625	429	CZE
	U0955	subsp. *dioica*	LR	0,570	4	1,5	1,9	3	N49.03808	E14.80625	429	CZE
	U0956	subsp. *dioica*	LR	0,570	4	1,5	1,9	3	N49.03808	E14.80625	429	CZE
UP0321	U0957	subsp. *dioica*	LR	0,561	4	1,3	2,4	5	N49.82140	E14.33470	269	CZE
	U0958	subsp. *dioica*	LR	0,561	4	1,3	2,4	5	N49.82140	E14.33470	269	CZE
	U0959	subsp. *dioica*	LR	0,561	4	1,3	2,4	5	N49.82140	E14.33470	269	CZE
	U0960	subsp. *dioica*	LR	0,561	4	1,3	2,4	5	N49.82140	E14.33470	269	CZE
	U0961	subsp. *dioica*	LR	0,561	4	1,3	2,4	5	N49.82140	E14.33470	269	CZE
UP0322	U0962	subsp. *dioica*	LR	0,562	4	1,6	2,4	3	N50.25522	E14.54422	181	CZE
	U0963	subsp. *dioica*	LR	0,562	4	1,6	2,4	3	N50.25522	E14.54422	181	CZE
	U0964	subsp. *dioica*	LR	0,562	4	1,6	2,4	3	N50.25522	E14.54422	181	CZE
UP0323	U0965	subsp. *dioica*	LR	0,563	4	1,3	2,9	1	N50.42658	E14.14703	160	CZE
UP0324	U0969	subsp. *dioica*	LR	0,561	4	1,7	2,2	4	N49.21208	E13.50733	502	CZE
	U0970	subsp. *dioica*	LR	0,561	4	1,7	2,2	4	N49.21208	E13.50733	502	CZE
	U0971	subsp. *dioica*	LR	0,561	4	1,7	2,2	4	N49.21208	E13.50733	502	CZE
	U0972	subsp. *dioica*	LR	0,561	4	1,7	2,2	4	N49.21208	E13.50733	502	CZE

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UP0325	U0973	subsp. *dioica*	IR	0,586	4	1,6	1,4	1	N48.90803	E15.82213	397	CZE
	U0974	subsp. *dioica*	IR	0,565	4	1,2	1,8	3	N48.90803	E15.82213	397	CZE
	U0975	subsp. *dioica*	IR	0,565	4	1,2	1,8	3	N48.90803	E15.82213	397	CZE
	U0976	subsp. *dioica*	IR	0,565	4	1,2	1,8	3	N48.90803	E15.82213	397	CZE
UP0326	U0982	subsp. *dioica*	LR	0,575	4	1,2	2,2	2	N50.44767	E14.16128	158	CZE
	U0983	subsp. *dioica*	LR	0,575	4	1,2	2,2	2	N50.44767	E14.16128	158	CZE
UP0327	U0990	subsp. *dioica*	LR	0,570	4	1,5	1,2	1	N50.39678	E14.08764	168	CZE
	U0991	subsp. *dioica*	LR	0,572	4	2,6	2,9	1	N50.39678	E14.08764	168	CZE
	U0992	subsp. *subinermis*	LR	0,289	2	1,5	2,8	1	N50.39678	E14.08764	168	CZE
UP0328	U0993	subsp. *dioica*	LR	0,565	4	1,8	2,4	4	N50.19267	E14.67136	171	CZE
	U0994	subsp. *dioica*	LR	0,565	4	1,8	2,4	4	N50.19267	E14.67136	171	CZE
	U0995	subsp. *dioica*	LR	0,565	4	1,8	2,4	4	N50.19267	E14.67136	171	CZE
	U0996	subsp. *dioica*	LR	0,565	4	1,8	2,4	4	N50.19267	E14.67136	171	CZE
UP0329	U0997	subsp. *dioica*	TU	0,558	4	1,4	2,0	2	N50.13325	E14.39417	178	CZE
	U0998	subsp. *dioica*	TU	0,558	4	1,4	2,0	2	N50.13325	E14.39417	178	CZE
UP0330	U1001	subsp. *dioica*	LR	0,596	4	1,2	2,7	1	N49.43979	E14.19153	354	CZE
UP0331	U1002	subsp. *dioica*	LR	0,595	4	1,3	2,1	1	N49.43874	E14.19307	354	CZE
UP0332	U1003	subsp. *dioica*	LR	0,604	4	1,3	4,6	1	N49.43776	E14.19257	354	CZE
UP0333	U1006	subsp. *dioica*	LR	0,591	4	0,9	4,1	1	N49.43946	E14.19011	354	CZE
UP0334	U1009	subsp. *dioica*	FK	0,567	4	0,8	1,1	1	N52.47448	E13.26699	38	DEU
UP0335	U1014	subsp. *dioica*	LR	0,587	4	0,9	1,1	2	N45.07807	E13.64188	17	HRV
	U1015	subsp. *dioica*	LR	0,580	4	1,1	1,3	2	N45.07807	E13.64188	17	HRV
UP0336	U1017	subsp. *dioica*	LR	0,576	4	0,7	1,0	5	N45.07626	E13.64170	20	HRV
UP0337	U1018	subsp. *dioica*	FK	0,593	4	1,4	1,8	1	N41.83395	E43.32967	600	GEO
	U2896	subsp. *dioica*	FK	0,571	4	1,0	2,3	1	N41.83395	E43.32967	934	GEO
UP0338	U1019	subsp. *dioica*	RB	0,562	4	1,3	1,6	3	N48.88340	E17.07230	180	CZE
	U1020	subsp. *dioica*	RB	0,562	4	1,3	1,6	3	N48.88340	E17.07230	180	CZE
	U1021	subsp. *dioica*	RB	0,562	4	1,3	1,6	3	N48.88340	E17.07230	180	CZE
UP0339	U1022	subsp. *dioica*	RB	0,565	4	1,2	2,0	1	N48.88697	E17.06596	172	CZE
	U1023	subsp. *dioica*	RB	0,573	4	1,5	1,6	1	N48.88697	E17.06596	172	CZE
	U1024	subsp. *dioica*	RB	0,578	4	1,3	1,7	1	N48.88697	E17.06596	172	CZE
	U1025	subsp. *dioica*	RB	0,558	4	1,4	2,1	1	N48.88697	E17.06596	172	CZE
UP0340	U1026	subsp. *subinermis*	RB	0,289	2	1,4	1,9	1	N48.88807	E17.07454	175	CZE
	U1027	subsp. *subinermis*	RB	0,291	2	1,4	1,9	1	N48.88807	E17.07454	175	CZE
UP0341	U1028	subsp. *dioica*	RB	0,559	4	1,3	2,2	4	N48.88909	E17.07427	179	CZE
	U1029	subsp. *dioica*	RB	0,559	4	1,3	2,2	4	N48.88909	E17.07427	179	CZE
	U1030	subsp. *dioica*	RB	0,559	4	1,3	2,2	4	N48.88909	E17.07427	179	CZE
	U1031	subsp. *dioica*	RB	0,559	4	1,3	2,2	4	N48.88909	E17.07427	179	CZE
UP0342	U1032	subsp. *dioica*	RB	0,558	4	1,2	1,8	1	N48.88961	E17.07668	180	CZE
	U1033	subsp. *dioica*	RB	0,564	4	1,2	1,7	1	N48.88961	E17.07668	180	CZE
	U1034	subsp. *dioica*	RB	0,569	4	1,6	2,2	1	N48.88961	E17.07668	180	CZE

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	U1035	subsp. *dioica*	RB	0,563	4	0,9	1,8	1	N48.88961	E17.07668	180	CZE
UP0343	U1042	subsp. *dioica*	LR	0,567	4	1,3	2,3	3	N50.17750	E14.92461	185	CZE
	U1043	subsp. *dioica*	LR	0,567	4	1,3	2,3	3	N50.17750	E14.92461	185	CZE
	U1044	subsp. *dioica*	LR	0,567	4	1,3	2,3	3	N50.17750	E14.92461	185	CZE
UP0344	U1045	subsp. *dioica*	LR	0,567	4	1,3	2,0	4	N50.17489	E14.92442	188	CZE
	U1046	subsp. *dioica*	LR	0,567	4	1,3	2,0	4	N50.17489	E14.92442	188	CZE
	U1047	subsp. *dioica*	LR	0,567	4	1,3	2,0	4	N50.17489	E14.92442	188	CZE
	U1048	subsp. *dioica*	LR	0,567	4	1,3	2,0	4	N50.17489	E14.92442	188	CZE
UP0345	U1049	subsp. *dioica*	LR	0,552	4	1,5	2,1	5	N50.17431	E14.92386	187	CZE
	U1050	subsp. *dioica*	LR	0,552	4	1,5	2,1	5	N50.17431	E14.92386	187	CZE
	U1051	subsp. *dioica*	LR	0,552	4	1,5	2,1	5	N50.17431	E14.92386	187	CZE
	U1052	subsp. *dioica*	LR	0,552	4	1,5	2,1	5	N50.17431	E14.92386	187	CZE
	U1053	subsp. *dioica*	LR	0,552	4	1,5	2,1	5	N50.17431	E14.92386	187	CZE
UP0346	U1054	subsp. *dioica*	LR	0,564	4	1,8	2,4	5	N50.17261	E14.92244	186	CZE
	U1055	subsp. *dioica*	LR	0,564	4	1,8	2,4	5	N50.17261	E14.92244	186	CZE
	U1056	subsp. *dioica*	LR	0,564	4	1,8	2,4	5	N50.17261	E14.92244	186	CZE
	U1057	subsp. *dioica*	LR	0,564	4	1,8	2,4	5	N50.17261	E14.92244	186	CZE
	U1058	subsp. *dioica*	LR	0,564	4	1,8	2,4	5	N50.17261	E14.92244	186	CZE
UP0347	U1059	subsp. *dioica*	LR	0,571	4	1,9	2,6	5	N50.17172	E14.92242	188	CZE
	U1060	subsp. *dioica*	LR	0,571	4	1,9	2,6	5	N50.17172	E14.92242	188	CZE
	U1061	subsp. *dioica*	LR	0,571	4	1,9	2,6	5	N50.17172	E14.92242	188	CZE
	U1062	subsp. *dioica*	LR	0,571	4	1,9	2,6	5	N50.17172	E14.92242	188	CZE
	U1063	subsp. *dioica*	LR	0,571	4	1,9	2,6	5	N50.17172	E14.92242	188	CZE
UP0348	U1064	subsp. *dioica*	LR	0,562	4	1,2	2,1	3	N50.17131	E14.92033	184	CZE
	U1065	subsp. *dioica*	LR	0,562	4	1,2	2,1	3	N50.17131	E14.92033	184	CZE
	U1066	subsp. *dioica*	LR	0,562	4	1,2	2,1	3	N50.17131	E14.92033	184	CZE
UP0349	U1067	subsp. *dioica*	LR	0,559	4	1,6	2,2	3	N50.17044	E14.91961	186	CZE
	U1068	subsp. *dioica*	LR	0,559	4	1,6	2,2	3	N50.17044	E14.91961	186	CZE
	U1069	subsp. *dioica*	LR	0,559	4	1,6	2,2	3	N50.17044	E14.91961	186	CZE
UP0350	U1070	subsp. *dioica*	LR	0,573	4	1,3	2,6	2	N50.16842	E14.92111	187	CZE
	U1071	subsp. *dioica*	LR	0,573	4	1,3	2,6	2	N50.16842	E14.92111	187	CZE
UP0351	U1072	subsp. *dioica*	LR	0,569	4	1,4	2,2	3	N50.17006	E14.91981	185	CZE
	U1073	subsp. *dioica*	LR	0,569	4	1,4	2,2	3	N50.17006	E14.91981	185	CZE
	U1074	subsp. *dioica*	LR	0,569	4	1,4	2,2	3	N50.17006	E14.91981	185	CZE
UP0352	U1075	subsp. *dioica*	LR	0,563	4	1,2	2,3	3	N50.11425	E15.17731	196	CZE
	U1076	subsp. *dioica*	LR	0,563	4	1,2	2,3	3	N50.11425	E15.17731	196	CZE
	U1077	subsp. *dioica*	LR	0,563	4	1,2	2,3	3	N50.11425	E15.17731	196	CZE
UP0353	U1078	subsp. *dioica*	LR	0,550	4	1,3	2,6	3	N50.11203	E15.17381	202	CZE
	U1079	subsp. *dioica*	LR	0,550	4	1,3	2,6	3	N50.11203	E15.17381	202	CZE
	U1080	subsp. *dioica*	LR	0,550	4	1,3	2,6	3	N50.11203	E15.17381	202	CZE
UP0354	U1081	subsp. *dioica*	LR	0,555	4	1,6	2,3	5	N50.11197	E15.17275	203	CZE

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	U1082	subsp. *dioica*	LR	0,555	4	1,6	2,3	5	N50.11197	E15.17275	203	CZE
	U1083	subsp. *dioica*	LR	0,555	4	1,6	2,3	5	N50.11197	E15.17275	203	CZE
	U1084	subsp. *dioica*	LR	0,555	4	1,6	2,3	5	N50.11197	E15.17275	203	CZE
	U1085	subsp. *dioica*	LR	0,555	4	1,6	2,3	5	N50.11197	E15.17275	203	CZE
UP0355	U1086	subsp. *dioica*	LR	0,560	4	1,5	2,7	5	N50.11200	E15.17222	204	CZE
	U1087	subsp. *dioica*	LR	0,560	4	1,5	2,7	5	N50.11200	E15.17222	204	CZE
	U1088	subsp. *dioica*	LR	0,560	4	1,5	2,7	5	N50.11200	E15.17222	204	CZE
	U1089	subsp. *dioica*	LR	0,560	4	1,5	2,7	5	N50.11200	E15.17222	204	CZE
	U1090	subsp. *dioica*	LR	0,560	4	1,5	2,7	5	N50.11200	E15.17222	204	CZE
UP0356	U1091	subsp. *dioica*	LR	0,560	4	1,4	2,4	3	N50.11267	E15.16667	200	CZE
	U1092	subsp. *dioica*	LR	0,560	4	1,4	2,4	3	N50.11267	E15.16667	200	CZE
	U1093	subsp. *dioica*	LR	0,560	4	1,4	2,4	3	N50.11267	E15.16667	200	CZE
UP0357	U1094	subsp. *dioica*	LR	0,555	4	1,7	3,4	6	N50.11394	E15.16161	196	CZE
	U1095	subsp. *dioica*	LR	0,555	4	1,7	3,4	6	N50.11394	E15.16161	196	CZE
	U1096	subsp. *dioica*	LR	0,555	4	1,7	3,4	6	N50.11394	E15.16161	196	CZE
	U1097	subsp. *dioica*	LR	0,555	4	1,7	3,4	6	N50.11394	E15.16161	196	CZE
	U1098	subsp. *dioica*	LR	0,555	4	1,7	3,4	6	N50.11394	E15.16161	196	CZE
	U1099	subsp. *dioica*	LR	0,555	4	1,7	3,4	6	N50.11394	E15.16161	196	CZE
UP0358	U1100	subsp. *dioica*	LR	0,562	4	1,3	1,9	3	N50.11094	E15.16533	198	CZE
	U1101	subsp. *dioica*	LR	0,562	4	1,3	1,9	3	N50.11094	E15.16533	198	CZE
	U1102	subsp. *dioica*	LR	0,562	4	1,3	1,9	3	N50.11094	E15.16533	198	CZE
UP0359	U1103	subsp. *dioica*	LR	0,570	4	1,5	1,9	5	N50.10986	E15.16278	198	CZE
	U1104	subsp. *dioica*	LR	0,570	4	1,5	1,9	5	N50.10986	E15.16278	198	CZE
	U1105	subsp. *dioica*	LR	0,570	4	1,5	1,9	5	N50.10986	E15.16278	198	CZE
	U1106	subsp. *dioica*	LR	0,570	4	1,5	1,9	5	N50.10986	E15.16278	198	CZE
	U1107	subsp. *dioica*	LR	0,570	4	1,5	1,9	5	N50.10986	E15.16278	198	CZE
UP0360	U1108	subsp. *dioica*	LR	0,568	4	1,3	2,3	3	N50.11133	E15.16658	199	CZE
	U1109	subsp. *dioica*	LR	0,568	4	1,3	2,3	3	N50.11133	E15.16658	199	CZE
	U1110	subsp. *dioica*	LR	0,568	4	1,3	2,3	3	N50.11133	E15.16658	199	CZE
UP0361	U1111	subsp. *dioica*	LR	0,559	4	1,2	2,6	5	N50.11086	E15.17119	201	CZE
	U1112	subsp. *dioica*	LR	0,559	4	1,2	2,6	5	N50.11086	E15.17119	201	CZE
	U1113	subsp. *dioica*	LR	0,559	4	1,2	2,6	5	N50.11086	E15.17119	201	CZE
	U1114	subsp. *dioica*	LR	0,559	4	1,2	2,6	5	N50.11086	E15.17119	201	CZE
	U1115	subsp. *dioica*	LR	0,559	4	1,2	2,6	5	N50.11086	E15.17119	201	CZE
UP0362	U1116	subsp. *dioica*	LR	0,566	4	1,2	1,9	2	N50.11047	E15.17267	200	CZE
	U1117	subsp. *dioica*	LR	0,566	4	1,2	1,9	2	N50.11047	E15.17267	200	CZE
UP0363	U1118	subsp. *dioica*	LR	0,576	4	1,5	2,2	3	N50.07158	E15.16981	202	CZE
	U1119	subsp. *dioica*	LR	0,576	4	1,5	2,2	3	N50.07158	E15.16981	202	CZE
	U1120	subsp. *dioica*	LR	0,576	4	1,5	2,2	3	N50.07158	E15.16981	202	CZE
UP0364	U1121	subsp. *dioica*	LR	0,556	4	1,6	2,2	4	N50.07078	E15.16931	201	CZE
	U1122	subsp. *dioica*	LR	0,556	4	1,6	2,2	4	N50.07078	E15.16931	201	CZE

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	U1123	subsp. *dioica*	LR	0,556	4	1,6	2,2	4	N50.07078	E15.16931	201	CZE
	U1124	subsp. *dioica*	LR	0,556	4	1,6	2,2	4	N50.07078	E15.16931	201	CZE
UP0365	U1125	subsp. *dioica*	LR	0,538	4	1,8	2,3	3	N50.07069	E15.16914	202	CZE
	U1126	subsp. *dioica*	LR	0,538	4	1,8	2,3	3	N50.07069	E15.16914	202	CZE
	U1127	subsp. *dioica*	LR	0,538	4	1,8	2,3	3	N50.07069	E15.16914	202	CZE
UP0366	U1128	subsp. *dioica*	LR	0,566	4	1,4	2,3	4	N50.07044	E15.16886	202	CZE
	U1129	subsp. *dioica*	LR	0,566	4	1,4	2,3	4	N50.07044	E15.16886	202	CZE
	U1130	subsp. *dioica*	LR	0,566	4	1,4	2,3	4	N50.07044	E15.16886	202	CZE
	U1131	subsp. *dioica*	LR	0,566	4	1,4	2,3	4	N50.07044	E15.16886	202	CZE
UP0367	U1132	subsp. *dioica*	LR	0,565	4	1,3	1,8	3	N50.07033	E15.17000	204	CZE
	U1133	subsp. *dioica*	LR	0,565	4	1,3	1,8	3	N50.07033	E15.17000	204	CZE
	U1134	subsp. *dioica*	LR	0,565	4	1,3	1,8	3	N50.07033	E15.17000	204	CZE
UP0368	U1135	subsp. *dioica*	LR	0,578	4	1,3	1,9	3	N50.07142	E15.17064	202	CZE
	U1136	subsp. *dioica*	LR	0,578	4	1,3	1,9	3	N50.07142	E15.17064	202	CZE
	U1137	subsp. *dioica*	LR	0,578	4	1,3	1,9	3	N50.07142	E15.17064	202	CZE
UP0369	U1138	subsp. *dioica*	LR	0,563	4	1,4	2,5	5	N50.02236	E15.32689	200	CZE
	U1139	subsp. *dioica*	LR	0,563	4	1,4	2,5	5	N50.02236	E15.32689	200	CZE
	U1140	subsp. *dioica*	LR	0,563	4	1,4	2,5	5	N50.02236	E15.32689	200	CZE
	U1141	subsp. *dioica*	LR	0,563	4	1,4	2,5	5	N50.02236	E15.32689	200	CZE
	U1142	subsp. *dioica*	LR	0,563	4	1,4	2,5	5	N50.02236	E15.32689	200	CZE
UP0370	U1143	subsp. *dioica*	LR	0,561	4	2,1	2,0	6	N50.02250	E15.32658	201	CZE
	U1144	subsp. *dioica*	LR	0,561	4	2,1	2,0	6	N50.02250	E15.32658	201	CZE
	U1145	subsp. *dioica*	LR	0,561	4	2,1	2,0	6	N50.02250	E15.32658	201	CZE
	U1146	subsp. *dioica*	LR	0,561	4	2,1	2,0	6	N50.02250	E15.32658	201	CZE
	U1147	subsp. *dioica*	LR	0,561	4	2,1	2,0	6	N50.02250	E15.32658	201	CZE
	U1148	subsp. *dioica*	LR	0,561	4	2,1	2,0	6	N50.02250	E15.32658	201	CZE
UP0371	U1149	subsp. *dioica*	LR	0,564	4	1,3	2,4	3	N50.03561	E15.51017	209	CZE
	U1150	subsp. *dioica*	LR	0,564	4	1,3	2,4	3	N50.03561	E15.51017	209	CZE
	U1151	subsp. *dioica*	LR	0,564	4	1,3	2,4	3	N50.03561	E15.51017	209	CZE
UP0372	U1152	subsp. *dioica*	LR	0,560	4	1,3	2,5	3	N50.03622	E15.50931	207	CZE
	U1153	subsp. *dioica*	LR	0,560	4	1,3	2,5	3	N50.03622	E15.50931	207	CZE
	U1154	subsp. *dioica*	LR	0,560	4	1,3	2,5	3	N50.03622	E15.50931	207	CZE
UP0373	U1155	subsp. *dioica*	LR	0,551	4	1,3	2,5	3	N50.03639	E15.50922	208	CZE
	U1156	subsp. *dioica*	LR	0,551	4	1,3	2,5	3	N50.03639	E15.50922	208	CZE
	U1157	subsp. *dioica*	LR	0,551	4	1,3	2,5	3	N50.03639	E15.50922	208	CZE
UP0374	U1158	subsp. *dioica*	LR	0,557	4	1,6	2,9	3	N50.03692	E15.50883	207	CZE
	U1159	subsp. *dioica*	LR	0,557	4	1,6	2,9	3	N50.03692	E15.50883	207	CZE
	U1160	subsp. *dioica*	LR	0,557	4	1,6	2,9	3	N50.03692	E15.50883	207	CZE
UP0375	U1161	subsp. *dioica*	LR	0,567	4	1,6	1,8	2	N50.03692	E15.50878	207	CZE
	U1162	subsp. *dioica*	LR	0,567	4	1,6	1,8	2	N50.03692	E15.50878	207	CZE
	U1163	subsp. *dioica*	LR	0,603	4	1,3	2,4	1	N50.03692	E15.50878	207	CZE

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	U1164	subsp. *dioica*	LR	0,555	4	1,2	2,4	1	N50.03692	E15.50878	207	CZE
	U3630	subsp. *dioica*	LR	0,554	4	1,8	2,2	2	N50.03692	E15.50878	207	CZE
UP0376	U1165	subsp. *dioica*	LR	0,576	4	1,1	3,5	1	N44.86184	E15.60296	663	HRV
	U1166	subsp. *dioica*	LR	0,591	4	1,0	3,4	1	N44.86184	E15.60296	663	HRV
	U1350	subsp. *dioica*	LR	0,584	4	1,1	2,5	1	N44.86184	E15.60296	663	HRV
	U1351	subsp. *dioica*	LR	0,613	4	1,3	3,0	1	N44.86184	E15.60296	663	HRV
	U1352	subsp. *dioica*	LR	0,577	4	1,0	1,6	1	N44.86184	E15.60296	663	HRV
UP0377	U1167	subsp. *subinermis*	LR	0,304	2	1,1	3,7	1	N45.74481	E16.17747	99	HRV
	U1355	subsp. *subinermis*	LR	0,299	2	1,1	3,5	1	N45.74481	E16.17747	99	HRV
	U1356	subsp. *subinermis*	LR	0,300	2	1,3	4,4	1	N45.74481	E16.17747	99	HRV
	U1357	subsp. *subinermis*	LR	0,302	2	1,1	3,2	1	N45.74481	E16.17747	99	HRV
UP0378	U1168	subsp. *subinermis*	LR	0,315	2	0,9	2,4	1	N45.36678	E16.75156	93	HRV
UP0379	U1170	subsp. *subinermis*	LR	0,302	2	1,2	2,5	1	N45.71819	E16.21206	97	HRV
	U1171	subsp. *subinermis*	LR	0,309	2	1,4	2,9	1	N45.71819	E16.21206	97	HRV
UP0380	U1172	subsp. *dioica*	LR	0,563	4	0,9	3,9	1	N45.68881	E16.24772	98	HRV
	U1359	subsp. *dioica*	LR	0,572	4	1,1	1,7	1	N45.68881	E16.24772	98	HRV
	U1360	subsp. *dioica*	LR	0,583	4	1,2	3,3	1	N45.68881	E16.24772	98	HRV
	U1361	subsp. *dioica*	LR	0,574	4	1,9	2,6	1	N45.68881	E16.24772	98	HRV
UP0381	U1173	subsp. *dioica*	LR	0,599	4	1,1	2,3	1	N45.66028	E16.27800	97	HRV
UP0382	U1174	subsp. *dioica*	LR	0,584	4	1,1	2,1	1	N45.63306	E16.22733	98	HRV
	U1363	subsp. *dioica*	LR	0,570	4	1,3	3,4	1	N45.63306	E16.22733	98	HRV
UP0383	U1175	subsp. *subinermis*	LR	0,309	2	1,2	3,7	1	N45.38817	E16.67422	94	HRV
	U1376	subsp. *subinermis*	LR	0,303	2	1,5	3,3	1	N45.38817	E16.67422	94	HRV
UP0384	U1176	subsp. *subinermis*	LR	0,300	2	1,2	3,2	1	N45.36631	E16.69739	98	HRV
	U1377	subsp. *subinermis*	LR	0,299	2	1,2	2,9	1	N45.36631	E16.69739	98	HRV
	U1378	subsp. *subinermis*	LR	0,305	2	1,1	2,4	1	N45.36631	E16.69739	98	HRV
	U1379	subsp. *subinermis*	LR	0,300	2	0,8	4,5	1	N45.36631	E16.69739	98	HRV
	U1380	subsp. *subinermis*	LR	0,304	2	1,2	2,8	1	N45.36631	E16.69739	98	HRV
UP0385	U1177	subsp. *dioica*	LR	0,576	4	1,1	3,4	1	N45.31458	E16.79586	91	HRV
	U1178	subsp. *dioica*	LR	0,570	4	1,3	2,6	1	N45.31458	E16.79586	91	HRV
	U1381	subsp. *dioica*	LR	0,559	4	1,1	3,2	1	N45.31458	E16.79586	91	HRV
	U1382	subsp. *dioica*	LR	0,576	4	1,2	2,4	1	N45.31458	E16.79586	91	HRV
	U3301	subsp. *dioica*	LR	0,582	4	1,3	2,4	1	N45.31458	E16.79586	91	HRV
UP0386	U1179	subsp. *dioica*	LR	0,565	4	1,0	2,2	1	N45.31489	E16.79603	93	HRV
	U1383	subsp. *dioica*	LR	0,558	4	1,3	2,3	1	N45.31489	E16.79603	93	HRV
UP0387	U1180	subsp. *dioica*	LR	0,570	4	1,1	3,8	1	N45.33261	E16.87097	108	HRV
	U1181	subsp. *dioica*	LR	0,578	4	0,9	2,3	1	N45.33261	E16.87097	108	HRV
	U1182	subsp. *dioica*	LR	0,578	4	0,8	2,7	1	N45.33261	E16.87097	108	HRV
	U3302	subsp. *dioica*	LR	0,577	4	1,4	2,6	1	N45.33261	E16.87097	108	HRV
UP0388	U1183	subsp. *dioica*	LR	0,599	4	1,4	2,9	1	N45.33269	E16.87342	106	HRV
UP0389	U1184	subsp. *subinermis*	LR	0,296	2	1,1	3,2	1	N45.27072	E16.94061	91	HRV

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	U1185	subsp. *subinermis*	LR	0,302	2	1,3	3,7	1	N45.27072	E16.94061	91	HRV
	U1186	subsp. *subinermis*	LR	0,293	2	1,0	3,3	1	N45.27072	E16.94061	91	HRV
UP0390	U1187	subsp. *subinermis*	LR	0,300	2	0,8	3,3	1	N45.24886	E16.94675	90	BIH
	U1385	subsp. *subinermis*	LR	0,298	2	1,1	2,7	1	N45.24886	E16.94675	90	BIH
	U1386	subsp. *subinermis*	LR	0,300	2	1,2	3,7	1	N45.24886	E16.94675	90	BIH
UP0391	U1188	subsp. *dioica*	LR	0,570	4	1,8	2,5	1	N45.11825	E15.58606	243	HRV
UP0392	U1189	subsp. *dioica*	RB	0,572	4	0,7	1,1	5	N45.71882	E13.72987	232	ITA
	U1190	subsp. *dioica*	RB	0,572	4	0,7	1,1	5	N45.71882	E13.72987	232	ITA
	U1191	subsp. *dioica*	RB	0,572	4	0,7	1,1	5	N45.71882	E13.72987	232	ITA
	U1192	subsp. *dioica*	RB	0,572	4	0,7	1,1	5	N45.71882	E13.72987	232	ITA
	U1193	subsp. *dioica*	RB	0,572	4	0,7	1,1	5	N45.71882	E13.72987	232	ITA
UP0393	U1194	subsp. *pubescens*	RB	0,298	2	0,7	1,3	1	N45.87569	E13.43600	17	ITA
	U1195	subsp. *pubescens*	RB	0,292	2	0,7	1,3	1	N45.87569	E13.43600	17	ITA
	U1196	subsp. *pubescens*	RB	0,298	2	0,7	1,1	1	N45.87569	E13.43600	17	ITA
	U1197	subsp. *pubescens*	RB	0,295	2	0,7	1,7	1	N45.87569	E13.43600	17	ITA
	U1198	subsp. *pubescens*	RB	0,301	2	0,8	1,5	1	N45.87569	E13.43600	17	ITA
UP0394	U1199	subsp. *pubescens*	LR	0,295	2	1,5	1,1	1	N46.11852	E13.21936	137	ITA
	U1200	subsp. *pubescens*	LR	0,300	2	0,8	1,5	1	N46.11852	E13.21936	137	ITA
	U1201	subsp. *pubescens*	LR	0,296	2	0,7	1,4	1	N46.11852	E13.21936	137	ITA
	U1202	subsp. *pubescens*	LR	0,297	2	0,7	1,3	1	N46.11852	E13.21936	137	ITA
UP0395	U1203	subsp. *pubescens*	LR	0,301	2	0,8	1,6	1	N46.37548	E13.05119	284	ITA
	U1204	subsp. *pubescens*	LR	0,300	2	0,7	1,5	1	N46.37548	E13.05119	284	ITA
	U1205	subsp. *pubescens*	LR	0,295	2	0,8	1,3	1	N46.37548	E13.05119	284	ITA
	U1206	subsp. *pubescens*	LR	0,295	2	0,9	1,5	1	N46.37548	E13.05119	284	ITA
	U1207	subsp. *pubescens*	LR	0,295	2	0,7	1,5	1	N46.37548	E13.05119	284	ITA
UP0396	U1208	subsp. *pubescens*	LR	0,292	2	0,8	1,5	1	N46.39472	E13.22091	324	ITA
	U1209	subsp. *pubescens*	LR	0,302	2	0,6	1,3	1	N46.39472	E13.22091	324	ITA
	U1210	subsp. *pubescens*	LR	0,298	2	0,8	1,3	1	N46.39472	E13.22091	324	ITA
UP0397	U1211	subsp. *dioica*	LR	0,559	4	0,8	1,0	4	N46.54111	E13.67201	613	AUT
	U1212	subsp. *dioica*	LR	0,559	4	0,8	1,0	4	N46.54111	E13.67201	613	AUT
	U1213	subsp. *dioica*	LR	0,559	4	0,8	1,0	4	N46.54111	E13.67201	613	AUT
	U1214	subsp. *dioica*	LR	0,559	4	0,8	1,0	4	N46.54111	E13.67201	613	AUT
UP0398	U1215	subsp. *dioica*	HC	0,586	4	0,7	1,7	1	N50.74795	E0.18942	27	GBR
	U1216	subsp. *dioica*	HC	0,592	4	0,7	1,6	1	N50.74795	E0.18942	27	GBR
	U1217	subsp. *dioica*	HC	0,577	4	0,8	1,7	1	N50.74795	E0.18942	27	GBR
	U1218	subsp. *dioica*	HC	0,578	4	0,8	1,2	1	N50.74795	E0.18942	27	GBR
	U1219	subsp. *dioica*	HC	0,578	4	0,6	1,2	1	N50.74795	E0.18942	27	GBR
UP0399	U1220	subsp. *dioica*	HC	0,622	4	0,9	2,4	1	N50.76942	E0.17448	76	GBR
	U1221	subsp. *dioica*	HC	0,586	4	1,2	1,7	1	N50.76942	E0.17448	76	GBR
	U1222	subsp. *dioica*	HC	0,604	4	1,8	2,1	1	N50.76942	E0.17448	76	GBR
	U1223	subsp. *dioica*	HC	0,592	4	0,6	1,8	1	N50.76942	E0.17448	76	GBR

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	U1224	subsp. *dioica*	HC	0,580	4	1,5	2,2	1	N50.76942	E0.17448	76	GBR
UP0400	U1225	subsp. *dioica*	HC	0,578	4	1,0	1,8	1	N51.33255	E0.05405	169	GBR
	U1226	subsp. *dioica*	HC	0,584	4	0,8	1,9	1	N51.33255	E0.05405	169	GBR
	U1227	subsp. *dioica*	HC	0,605	4	1,2	2,2	1	N51.33255	E0.05405	169	GBR
	U1228	subsp. *dioica*	HC	0,582	4	1,3	2,3	1	N51.33255	E0.05405	169	GBR
	U1229	subsp. *dioica*	HC	0,582	4	0,9	1,8	1	N51.33255	E0.05405	169	GBR
UP0401	U1231	subsp. *dioica*	HC	0,592	4	0,9	1,3	1	N51.45587	E0.01853	20	GBR
	U1232	subsp. *dioica*	HC	0,606	4	0,9	1,6	1	N51.45587	E0.01853	20	GBR
	U1233	subsp. *dioica*	HC	0,633	4	1,0	1,6	1	N51.45587	E0.01853	20	GBR
	U1234	subsp. *dioica*	HC	0,611	4	0,7	1,6	1	N51.45587	E0.01853	20	GBR
UP0402	U1235	subsp. *subinermis*	BS, KSE	0,305	2	1,0	2,5	1	N61.48951	E23.79006	80	FIN
UP0403	U1236	subsp. *subinermis*	BS, KSE	0,311	2	0,9	3,2	1	N61.49465	E23.79238	119	FIN
UP0404	U1237	subsp. *sondenii*	BS, KSE	0,302	2	0,8	1,7	1	N61.48636	E23.68982	94	FIN
UP0405	U1238	subsp. *sondenii*	BS, KSE	0,308	2	0,8	2,7	1	N61.48420	E23.69830	84	FIN
UP0406	U1239	subsp. *sondenii*	BS, KSE	0,300	2	0,8	2,7	1	N61.46638	E23.73464	83	FIN
UP0407	U1240	subsp. *sondenii*	BS, KSE	0,294	2	1,0	2,3	1	N61.47259	E23.74331	83	FIN
UP0408	U1241	subsp. *subinermis*	BS, KSE	0,304	2	0,7	2,3	1	N61.51436	E23.77772	102	FIN
UP0409	U1242	subsp. *subinermis*	BS, KSE	0,312	2	0,7	3,2	1	N60.84215	E24.59997	98	FIN
UP0410	U1243	subsp. *subinermis*	BS, KSE	0,301	2	1,0	2,3	1	N61.30560	E23.96916	106	FIN
UP0411	U1244	subsp. *sondenii*	BS, KSE	0,301	2	1,0	2,8	1	N68.16568	E14.66502	1	NOR
UP0412	U1245	subsp. *sondenii*	BS, KSE	0,302	2	1,0	2,6	1	N68.16739	E14.66380	1	NOR
UP0413	U1246	subsp. *sondenii*	BS, KSE	0,308	2	0,9	2,2	1	N68.03581	E13.34848	9	NOR
UP0414	U1247	subsp. *sondenii*	BS, KSE	0,299	2	1,0	2,9	1	N68.03381	E13.34800	15	NOR
UP0415	U1248	subsp. *sondenii*	BS, KSE	0,316	2	1,0	3,7	1	N68.14789	E14.19803	1	NOR
UP0416	U1249	subsp. *sondenii*	BS, KSE	0,308	2	0,8	2,4	1	N68.15561	E14.21187	1	NOR
UP0417	U1250	subsp. *dioica*	BS, KSE	0,612	4	0,8	2,0	1	N69.01995	E15.12213	1	NOR
UP0418	U1251	subsp. *sondenii*	BS, KSE	0,302	2	0,7	1,9	1	N69.11327	E15.98409	1	NOR
UP0419	U1252	subsp. *sondenii*	BS, KSE	0,303	2	0,9	2,7	1	N67.27269	E14.37982	13	NOR
UP0420	U1253	subsp. *sondenii*	BS, KSE	0,304	2	1,1	3,5	1	N67.27018	E14.33708	1	NOR
UP0421	U1254	subsp. *sondenii*	BS, KSE	0,306	2	0,7	2,4	1	N61.47048	E23.88040	99	FIN
UP0422	U1255	subsp. *sondenii*	BS, KSE	0,306	2	1,9	2,2	1	N61.47315	E23.89520	97	FIN
UP0423	U1256	subsp. *sondenii*	BS, KSE	0,303	2	0,9	2,1	1	N61.50715	E23.61435	129	FIN
UP0424	U1257	subsp. *sondenii*	BS, KSE	0,304	2	0,7	2,3	1	N61.51227	E23.63980	105	FIN
UP0425	U1258	subsp. *subinermis*	BS, KSE	0,302	2	0,9	2,6	1	N61.78543	E25.47773	91	FIN
UP0426	U1259	subsp. *subinermis*	BS, KSE	0,305	2	0,8	2,6	1	N61.79176	E25.47760	131	FIN
UP0427	U1260	subsp. *sondenii*	BS, KSE	0,308	2	0,8	2,8	1	N62.83056	E27.68569	81	FIN
UP0428	U1261	subsp. *sondenii*	BS, KSE	0,308	2	0,8	2,4	1	N62.82746	E27.69895	83	FIN
UP0429	U1268	subsp. *dioica*	LR	0,572	4	0,9	2,4	1	N39.44106	W5.31467	525	ESP
	U1269	subsp. *dioica*	LR	0,602	4	1,7	3,7	1	N39.44106	W5.31467	525	ESP
	U1270	subsp. *dioica*	LR	0,589	4	1,0	1,3	1	N39.44106	W5.31467	525	ESP
	U1271	subsp. *dioica*	LR	0,580	4	1,7	2,0	1	N39.44106	W5.31467	525	ESP

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	U1272	subsp. *dioica*	LR	0,580	4	0,7	2,8	1	N39.44106	W5.31467	525	ESP
	U1273	subsp. *dioica*	LR	0,614	4	1,0	3,6	1	N39.44106	W5.31467	525	ESP
	U1274	subsp. *dioica*	LR	0,585	4	1,2	3,3	1	N39.44106	W5.31467	525	ESP
UP0430	U1275	subsp. *dioica*	LR	0,593	4	1,4	3,7	1	N40.11544	W5.83850	1221	ESP
	U1277	subsp. *dioica*	LR	0,595	4	1,1	2,6	1	N40.11544	W5.83850	1221	ESP
	U1279	subsp. *dioica*	LR	0,589	4	1,4	2,8	1	N40.11544	W5.83850	1221	ESP
UP0431	U1280	subsp. *dioica*	LR	0,600	4	1,3	4,1	1	N39.64611	W5.81836	354	ESP
	U1281	subsp. *dioica*	LR	0,564	4	1,1	2,3	1	N39.64611	W5.81836	354	ESP
	U1282	subsp. *dioica*	LR	0,603	4	1,6	2,4	1	N39.64611	W5.81836	354	ESP
	U1283	subsp. *dioica*	LR	0,572	4	1,0	2,9	1	N39.64611	W5.81836	354	ESP
	U1284	subsp. *dioica*	LR	0,613	4	1,2	3,2	1	N39.64611	W5.81836	354	ESP
	U1285	subsp. *dioica*	LR	0,583	4	0,9	1,3	1	N39.64611	W5.81836	354	ESP
UP0432	U1296	subsp. *dioica*	LR	0,591	4	1,4	3,2	1	N40.56883	W6.09161	962	ESP
	U1297	subsp. *dioica*	LR	0,596	4	1,4	3,4	1	N40.56883	W6.09161	962	ESP
	U1299	subsp. *dioica* pentaploid	LR	0,771	5	0,8	3,2	1	N40.56883	W6.09161	962	ESP
	U1300	subsp. *dioica*	LR	0,597	4	1,6	2,9	1	N40.56883	W6.09161	962	ESP
	U1301	subsp. *dioica*	LR	0,623	4	1,0	3,7	1	N40.56883	W6.09161	962	ESP
	U1302	subsp. *dioica*	LR	0,589	4	1,2	3,3	1	N40.56883	W6.09161	962	ESP
	U1303	subsp. *dioica*	LR	0,612	4	1,2	3,9	1	N40.56883	W6.09161	962	ESP
	U1304	subsp. *dioica*	LR	0,606	4	0,9	4,3	1	N40.56883	W6.09161	962	ESP
UP0433	U1311	subsp. *dioica*	HC	0,616	4	1,4	2,7	1	N45.72545	E10.84377	2168	ITA
	U1312	subsp. *dioica*	HC	0,604	4	1,3	2,3	1	N45.72545	E10.84377	2168	ITA
	U1313	subsp. *dioica*	HC	0,596	4	1,1	1,7	1	N45.72545	E10.84377	2168	ITA
UP0434	U1314	subsp. *dioica*	HC	0,596	4	1,2	1,8	1	N45.64280	E10.60287	174	ITA
	U1315	subsp. *dioica*	HC	0,610	4	1,1	3,0	1	N45.64280	E10.60287	174	ITA
	U1316	subsp. *dioica*	HC	0,607	4	1,0	2,6	1	N45.64280	E10.60287	174	ITA
UP0435	U1317	subsp. *dioica*	FK	0,594	4	1,1	2,9	1	N69.65605	E18.93484	100	NOR
	U1318	subsp. *dioica*	FK	0,592	4	0,9	2,3	1	N69.65605	E18.93484	100	NOR
	U1319	subsp. *sondenii*	FK	0,306	2	1,2	3,3	1	N69.65605	E18.93484	100	NOR
	U1320	subsp. *sondenii*	FK	0,304	2	1,4	3,4	1	N69.65605	E18.93484	100	NOR
UP0436	U1321	subsp. *sondenii*	FK	0,298	2	1,0	2,4	1	N69.67887	E18.89820	1	NOR
	U1322	subsp. *sondenii*	FK	0,325	2	1,2	2,1	1	N69.67887	E18.89820	1	NOR
UP0437	U1328	subsp. *dioica*	LR	0,558	4	1,1	1,9	6	N49.25981	E13.94494	387	CZE
	U1329	subsp. *dioica*	LR	0,558	4	1,1	1,9	6	N49.25981	E13.94494	387	CZE
	U1330	subsp. *dioica*	LR	0,558	4	1,1	1,9	6	N49.25981	E13.94494	387	CZE
	U1331	subsp. *dioica*	LR	0,558	4	1,1	1,9	6	N49.25981	E13.94494	387	CZE
	U1332	subsp. *dioica*	LR	0,558	4	1,1	1,9	6	N49.25981	E13.94494	387	CZE
	U1333	subsp. *dioica*	LR	0,558	4	1,1	1,9	6	N49.25981	E13.94494	387	CZE
UP0438	U1334	subsp. *dioica*	LR	0,607	4	0,9	3,2	1	N48.65858	E16.96608	171	CZE
	U1335	subsp. *dioica*	LR	0,565	4	0,9	2,6	1	N48.65858	E16.96608	171	CZE
UP0439	U1343	subsp. *subinermis*	DR	0,307	2	1,6	2,5	1	N45.38767	E20.20983	84	SRB

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	U1344	subsp. *subinermis*	DR	0,310	2	0,8	2,0	1	N45.38767	E20.20983	85	SRB
UP0440	U1345	subsp. *dioica*	DR	0,608	4	1,2	2,1	1	N45.38464	E19.89236	75	SRB
	U1346	subsp. *dioica*	DR	0,601	4	1,2	1,5	1	N45.38464	E19.89236	75	SRB
UP0441	U1347	subsp. *dioica*	DR	0,582	4	1,1	2,8	1	N45.64764	E19.90456	80	SRB
	U1348	subsp. *dioica*	DR	0,581	4	1,4	1,9	1	N45.64764	E19.90456	80	SRB
UP0442	U1353	subsp. *dioica*	LR	0,569	4	1,6	2,7	1	N44.67164	E15.61206	376	HRV
	U1354	subsp. *dioica*	LR	0,600	4	1,6	3,3	1	N44.67164	E15.61206	376	HRV
UP0443	U1358	subsp. *dioica*	LR	0,597	4	1,6	2,6	1	N45.74489	E16.17436	101	HRV
UP0444	U1362	subsp. *subinermis*	LR	0,301	2	1,6	3,3	1	N44.88727	E15.60123	603	HRV
	U1364	subsp. *dioica*	LR	0,578	4	1,5	3,4	1	N44.88727	E15.60123	603	HRV
UP0445	U1365	subsp. *dioica*	LR	0,570	4	0,9	2,3	1	N45.63756	E16.28308	99	HRV
	U3300	subsp. *dioica*	LR	0,569	4	1,2	2,6	1	N45.63756	E16.28308	99	HRV
UP0446	U1366	subsp. *dioica*	LR	0,575	4	1,4	1,9	1	N45.44219	E16.47836	96	HRV
	U1367	subsp. *dioica*	LR	0,564	4	1,1	2,5	1	N45.44219	E16.47836	96	HRV
UP0447	U1368	subsp. *subinermis*	LR	0,301	2	1,5	3,9	1	N45.41522	E16.57194	91	HRV
	U1369	subsp. *subinermis*	LR	0,302	2	1,1	2,6	1	N45.41522	E16.57194	91	HRV
	U1370	subsp. *subinermis*	LR	0,308	2	1,3	3,0	1	N45.41522	E16.57194	91	HRV
UP0448	U1371	subsp. *dioica*	LR	0,563	4	1,0	3,5	1	N45.42283	E16.60911	94	HRV
	U1372	subsp. *subinermis*	LR	0,296	2	0,9	3,1	1	N45.42283	E16.60911	94	HRV
	U1373	subsp. *subinermis*	LR	0,293	2	1,9	3,2	1	N45.42283	E16.60911	94	HRV
	U1374	subsp. *dioica*	LR	0,560	4	1,3	2,4	1	N45.42283	E16.60911	94	HRV
UP0449	U1387	subsp. *dioica*	FK	0,575	4	1,3	1,5	4	N48.80190	E12.98233	315	DEU
UP0450	U1406	subsp. *dioica*	LR	0,587	4	1,2	2,9	1	N56.99045	E23.87425	12	LVA
	U1407	subsp. *dioica*	LR	0,566	4	1,9	3,3	1	N56.99045	E23.87425	12	LVA
	U1408	subsp. *dioica*	LR	0,567	4	1,1	1,6	1	N56.99045	E23.87425	12	LVA
UP0451	U1409	subsp. *dioica*	LR	0,607	4	1,6	3,9	1	N56.97942	E23.87247	4	LVA
	U1410	subsp. *dioica*	LR	0,568	4	1,0	1,8	1	N56.97942	E23.87247	4	LVA
	U1411	subsp. *dioica*	LR	0,581	4	1,6	2,3	1	N56.97942	E23.87247	4	LVA
	U1412	subsp. *dioica*	LR	0,635	4	1,7	4,3	1	N56.97942	E23.87247	4	LVA
UP0452	U1413	subsp. *dioica*	LR	0,578	4	1,1	2,3	1	N57.06205	E24.04180	5	LVA
	U1414	subsp. *dioica*	LR	0,567	4	2,1	2,9	1	N57.06205	E24.04180	5	LVA
	U1415	subsp. *dioica*	LR	0,580	4	1,0	1,2	1	N57.06205	E24.04180	5	LVA
	U1416	subsp. *dioica*	LR	0,575	4	1,0	3,7	1	N57.06205	E24.04180	5	LVA
UP0453	U1420	subsp. *dioica*	LR	0,566	4	1,2	2,1	1	N57.31392	E25.26653	88	LVA
	U1421	subsp. *dioica*	LR	0,615	4	1,9	3,9	1	N57.31392	E25.26653	88	LVA
	U1422	subsp. *dioica*	LR	0,605	4	1,5	2,6	1	N57.31392	E25.26653	88	LVA
UP0454	U1426	subsp. *dioica*	LR	0,577	4	1,3	3,4	1	N56.48862	E23.37308	71	LVA
	U1427	subsp. *dioica*	LR	0,579	4	1,1	3,2	1	N56.48862	E23.37308	71	LVA
	U1428	subsp. *dioica*	LR	0,579	4	1,6	2,3	1	N56.48862	E23.37308	71	LVA
	U1429	subsp. *dioica*	LR	0,591	4	1,4	3,1	1	N56.48862	E23.37308	71	LVA
UP0455	U1430	subsp. *dioica*	LR	0,577	4	2,1	3,3	1	N56.41448	E24.02425	21	LVA

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	U1431	subsp. *dioica*	LR	0,599	4	1,8	4,4	1	N56.41448	E24.02425	21	LVA
UP0456	U1442	subsp. *dioica*	LR	0,607	4	1,7	4,8	1	N57.39730	E21.56268	3	LVA
	U1443	subsp. *dioica*	LR	0,573	4	0,9	1,8	1	N57.39730	E21.56268	3	LVA
	U1444	subsp. *dioica*	LR	0,592	4	1,9	4,3	1	N57.39730	E21.56268	3	LVA
UP0457	U1528	subsp. *dioica*	JPR	0,566	4	1,2	2,6	1	N42.32672	W3.01102	811	ESP
UP0458	U1529	subsp. *subinermis*	JR	0,298	2	1,2	1,8	1	N48.44764	E22.13367	103	SVK
	U1530	subsp. *subinermis*	JR	0,298	2	1,6	1,8	1	N48.44764	E22.13367	103	SVK
	U1531	subsp. *subinermis*	JR	0,294	2	1,5	2,2	1	N48.44764	E22.13367	103	SVK
	U1532	subsp. *subinermis*	JR	0,299	2	1,2	2,2	1	N48.44764	E22.13367	103	SVK
	U1533	subsp. *subinermis*	JR	0,297	2	1,0	2,0	1	N48.44764	E22.13367	103	SVK
	U1534	subsp. *subinermis*	JR	0,298	2	1,0	1,9	1	N48.44764	E22.13367	103	SVK
	U1535	subsp. *subinermis*	JR	0,300	2	1,2	2,1	1	N48.44764	E22.13367	103	SVK
	U1536	subsp. *subinermis*	JR	0,300	2	1,1	2,3	1	N48.44764	E22.13367	103	SVK
UP0459	U1537	subsp. *dioica*	JV, PV	0,621	4	1,2	2,9	1	N47.26552	E13.14493	2122	AUT
	U1538	subsp. *dioica*	JV, PV	0,615	4	1,8	3,9	1	N47.26552	E13.14493	2122	AUT
	U1539	subsp. *dioica*	JV, PV	0,584	4	1,7	2,2	1	N47.26552	E13.14493	2122	AUT
	U1540	subsp. *dioica*	JV, PV	0,627	4	2,0	3,0	1	N47.26552	E13.14493	2122	AUT
UP0460	U1541	subsp. *dioica*	AK, KS	0,585	4	1,9	4,2	1	N46.48827	E23.36598	901	ROU
	U1542	subsp. *dioica*	AK, KS	0,584	4	1,3	2,7	1	N46.48827	E23.36598	901	ROU
	U1544	subsp. *dioica*	AK, KS	0,584	4	1,3	3,4	1	N46.48827	E23.36598	901	ROU
UP0461	U1545	subsp. *dioica*	JV, PV	0,584	4	1,6	2,6	1	N45.45233	E25.88427	1463	ROU
	U1547	subsp. *dioica*	JV, PV	0,572	4	1,6	2,4	1	N45.45233	E25.88427	1463	ROU
	U1548	subsp. *dioica*	JV, PV	0,597	4	1,7	2,9	1	N45.45233	E25.88427	1463	ROU
	U1549	subsp. *dioica*	JV, PV	0,570	4	1,1	2,1	1	N45.45233	E25.88427	1463	ROU
UP0462	U1552	subsp. *dioica*	FK	0,580	4	1,6	3,5	1	N54.97653	E12.52559	104	DNK
	U1553	subsp. *dioica*	FK	0,579	4	1,2	2,4	1	N54.97653	E12.52559	104	DNK
	U1554	subsp. *dioica*	FK	0,557	4	1,6	2,7	1	N54.97653	E12.52559	104	DNK
	U1555	subsp. *dioica*	FK	0,622	4	0,9	2,3	1	N54.97653	E12.52559	104	DNK
	U1556	subsp. *dioica*	FK	0,611	4	2,1	2,8	1	N54.97653	E12.52559	104	DNK
	U1557	subsp. *dioica*	FK	0,572	4	1,3	2,6	1	N54.97653	E12.52559	104	DNK
UP0463	U1574	subsp. *dioica*	EZ, FK	0,572	4	1,2	2,4	1	N36.98810	W4.92534	422	ESP
	U1575	subsp. *dioica*	EZ, FK	0,583	4	1,0	2,3	1	N36.98810	W4.92534	422	ESP
	U1576	subsp. *dioica*	EZ, FK	0,613	4	0,8	2,0	1	N36.98810	W4.92534	422	ESP
	U1577	subsp. *dioica*	EZ, FK	0,588	4	1,0	2,5	1	N36.98810	W4.92534	422	ESP
	U1578	subsp. *dioica*	EZ, FK	0,597	4	1,5	3,6	1	N36.98810	W4.92534	422	ESP
UP0464	U1582	subsp. *dioica*	KK	0,586	4	1,5	2,8	5	N47.54571	E24.92977	1372	ROU
	U3656	subsp. *dioica*	KK	0,550	4	1,0	1,6	5	N47.54571	E24.92977	1372	ROU
UP0465	U1583	subsp. *dioica*	LR	0,578	4	0,8	1,1	1	N45.08942	E13.88261	311	HRV
	U1584	subsp. *dioica*	LR	0,589	4	0,7	0,9	1	N45.08942	E13.88261	311	HRV
	U1585	subsp. *dioica*	LR	0,566	4	0,8	0,9	1	N45.08942	E13.88261	311	HRV
	U1586	subsp. *dioica*	LR	0,580	4	0,9	1,1	1	N45.08942	E13.88261	311	HRV

ID number of population	ID number of analysis	Taxon	Collector	Relative fluorescence intensity	DNA-ploidy level	CV of standard	CV of sample	N. of individuals in analysis	Latitude (WGS-84)	Longitude (WGS-84)	Altitude (m a.s.l.)	Country (ISO 3166-1)
	U1587	subsp. *dioica*	LR	0,584	4	0,7	1,0	1	N45.08942	E13.88261	311	HRV
	U1588	subsp. *dioica*	LR	0,604	4	0,7	1,7	1	N45.08942	E13.88261	311	HRV
	U1589	subsp. *dioica*	LR	0,573	4	0,7	0,9	1	N45.08942	E13.88261	311	HRV
	U1590	subsp. *dioica*	LR	0,580	4	1,1	1,2	1	N45.08942	E13.88261	311	HRV
	U1591	subsp. *dioica*	LR	0,577	4	0,8	1,0	1	N45.08942	E13.88261	311	HRV
UP0466	U1592	subsp. *subinermis*	LR	0,318	2	0,9	1,4	1	N48.94444	E16.59044	183	CZE
	U1595	subsp. *subinermis*	LR	0,311	2	0,8	1,7	1	N48.94444	E16.59044	183	CZE
	U3561	subsp. *dioica*	LR	0,550	4	1,2	1,6	5	N48.94444	E16.59044	183	CZE
	U3570	U. *kioviensis*	FK	0,334	2	1,2	2,4	1	N48.94444	E16.59044	183	CZE
	U3571	U. *kioviensis*	FK	0,345	2	1,5	3,3	1	N48.94444	E16.59044	183	CZE
UP0467	U1597	U. *atrovirens*	LR	0,305	2	0,9	2,3	1	N42.13596	E8.60742	69	FRA
UP0468	U1598	subsp. *dioica*	KH	0,574	4	1,2	1,2	2	N45.67561	E7.31292	2008	ITA
UP0469	U1599	subsp. *subinermis*	LR	0,296	2	1,5	2,3	1	N41.74439	E8.87122	72	FRA
UP0470	U1600	subsp. *subinermis*	LR	0,300	2	1,5	2,2	1	N42.30683	E9.15045	435	FRA
UP0471	U1601	subsp. *subinermis*	LR	0,311	2	0,8	2,4	1	N42.38130	E9.15270	337	FRA
	U1602	subsp. *subinermis*	LR	0,301	2	1,8	2,4	1	N42.38130	E9.15270	337	FRA
	U1603	subsp. *subinermis*	LR	0,308	2	1,0	2,9	1	N42.38130	E9.15270	337	FRA
	U1604	subsp. *subinermis*	LR	0,295	2	2,6	1,7	1	N42.38130	E9.15270	337	FRA
	U1606	subsp. *subinermis*	LR	0,297	2	0,8	2,0	1	N42.38130	E9.15270	337	FRA
UP0472	U1607	subsp. *dioica*	KH	0,571	4	1,2	1,6	10	N45.07250	E2.71194	1240	FRA
UP0473	U1608	subsp. *dioica*	KH	0,565	4	1,4	1,6	2	N45.18192	E0.72219	92	FRA
UP0474	U1609	subsp. *dioica*	KH	0,571	4	1,4	1,6	3	N47.23167	E6.03194	327	FRA
UP0475	U1610	subsp. *dioica*	KH	0,574	4	1,4	1,6	4	N47.49472	E7.31747	561	FRA
UP0476	U1611	subsp. *dioica*	KH	0,578	4	1,6	1,4	3	N44.75194	E5.59806	1287	FRA
UP0477	U1612	subsp. *dioica*	KH	0,580	4	1,2	1,4	3	N46.61381	E5.85228	567	FRA
UP0478	U1613	subsp. *dioica*	KH	0,570	4	1,7	1,5	3	N44.11408	E7.28572	1486	FRA
UP0479	U1614	subsp. *dioica*	KH	0,580	4	1,3	1,4	2	N46.31075	E6.78419	1230	FRA
UP0480	U1615	subsp. *dioica*	FK	0,569	4	1,2	1,4	5	N40.95158	E20.84589	1474	MKD
UP0481	U1616	subsp. *dioica*	LR	0,595	4	1,0	3,4	1	N49.34185	E14.11678	427	CZE
	U1624	subsp. *dioica*	LR	0,568	4	1,1	4,0	1	N49.34185	E14.11678	427	CZE
	U3555	subsp. *dioica*	LR	0,569	4	1,2	1,8	1	N49.34185	E14.11678	426	CZE
	U3556	subsp. *dioica*	LR	0,559	4	0,7	1,6	1	N49.34185	E14.11678	426	CZE
UP0482	U1617	subsp. *dioica*	LR	0,571	4	0,9	1,9	1	N49.51612	E14.02878	440	CZE
	U1618	subsp. *dioica*	LR	0,569	4	1,0	1,5	1	N49.51612	E14.02878	440	CZE
UP0483	U1619	subsp. *dioica*	LR	0,563	4	0,7	1,6	1	N49.51605	E14.03003	441	CZE
	U1620	subsp. *dioica*	LR	0,567	4	1,2	1,8	1	N49.51605	E14.03003	441	CZE
UP0484	U1623	subsp. *dioica*	LR	0,577	4	0,8	1,8	1	N49.35007	E14.14567	354	CZE
	U1627	subsp. *dioica*	LR	0,575	4	1,2	2,2	1	N49.35007	E14.14567	354	CZE
UP0485	U1625	subsp. *dioica*	LR	0,562	4	0,8	1,6	1	N49.34187	E14.11592	420	CZE
	U3557	subsp. *dioica*	LR	0,565	4	0,6	1,8	1	N49.34187	E14.11592	420	CZE
UP0486	U1626	subsp. *dioica*	LR	0,569	4	0,7	1,5	1	N49.51625	E14.02915	441	CZE

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UP0487	U1630	subsp. *subinermis*	LR	0,301	2	0,7	1,7	1	N49.35520	E14.14777	356	CZE
	U1631	subsp. *subinermis*	LR	0,304	2	0,7	2,4	1	N49.35520	E14.14777	356	CZE
UP0488	U1633	subsp. *dioica*	FK	0,560	4	0,9	1,4	1	N50.59298	E5.44383	116	BEL
UP0489	U1634	subsp. *dioica*	FK	0,579	4	1,2	1,7	1	N50.42564	E7.27298	351	DEU
UP0490	U1635	subsp. *dioica*	FK	0,571	4	0,9	1,5	5	N50.62814	E8.73034	304	DEU
UP0491	U1636	subsp. *dioica*	FK	0,556	4	1,3	1,6	5	N50.47523	E10.01138	799	DEU
UP0492	U1637	subsp. *dioica*	FK	0,558	4	1,2	1,8	5	N50.24111	E7.56283	120	DEU
UP0493	U1638	subsp. *subinermis*	JR	0,304	2	1,3	2,6	1	N48.47194	E21.80556	96	SVK
	U1639	subsp. *subinermis*	JR	0,299	2	1,7	4,2	1	N48.47194	E21.80556	96	SVK
	U1640	subsp. *dioica* triploid	JR	0,429	3	1,2	2,6	1	N48.47194	E21.80556	96	SVK
	U1641	subsp. *subinermis*	JR	0,290	2	0,9	4,8	1	N48.47194	E21.80556	96	SVK
UP0494	U1643	subsp. *dioica*	LR	0,586	4	0,9	1,9	1	N46.81356	E18.93364	95	HUN
UP0495	U1644	subsp. *dioica*	FK	0,596	4	1,3	3,4	1	N45.58717	E13.72294	54	SVN
UP0496	U1645	subsp. *dioica*	FK	0,595	4	1,5	2,7	1	N47.43408	E13.46494	992	AUT
UP0497	U1650	subsp. *dioica*	FK	0,578	4	0,9	2,4	1	N53.18212	W4.26211	48	GBR
UP0498	U1651	subsp. *dioica*	FK	0,594	4	1,2	2,8	1	N53.23350	W4.11818	3	GBR
UP0499	U1652	subsp. *dioica*	FK	0,573	4	0,8	2,4	1	N56.14456	W4.03230	10	GBR
UP0500	U1653	subsp. *dioica*	LR	0,571	4	1,0	2,8	1	N53.48848	W2.26895	31	GBR
UP0501	U1654	subsp. *dioica*	FK	0,573	4	1,1	2,4	1	N56.03860	E12.62174	10	DNK
UP0502	U1655	subsp. *dioica*	FK	0,582	4	1,2	4,4	1	N60.04434	E10.78176	420	NOR
	U3399	subsp. *dioica*	FK	0,581	4	1,2	1,5	1	N60.04434	E10.78176	420	NOR
UP0503	U1657	subsp. *dioica*	LR	0,593	4	1,7	3,7	1	N61.14747	E8.63622	466	NOR
UP0504	U1659	subsp. *dioica*	DH	0,632	4	0,9	4,3	1	N49.32846	E14.20895	475	CZE
UP0505	U1663	subsp. *dioica*	FK	0,593	4	0,8	4,9	1	N42.68226	E22.05947	331	SRB
UP0506	U1664	subsp. *dioica*	FK	0,598	4	1,3	2,9	1	N41.29126	E21.16714	655	MKD
UP0507	U1667	subsp. *dioica*	KSR	0,568	4	1,0	1,3	3	N52.26017	E4.44542	9	NLD
	U1668	subsp. *dioica*	KSR	0,568	4	1,0	1,3	3	N52.26017	E4.44542	9	NLD
	U1669	subsp. *dioica*	KSR	0,568	4	1,0	1,3	3	N52.26017	E4.44542	9	NLD
UP0508	U1687	subsp. *dioica*	LR	0,578	4	1,1	1,4	4	N59.96352	E10.66717	326	NOR
	U1688	subsp. *dioica*	LR	0,578	4	1,1	1,4	4	N59.96352	E10.66717	326	NOR
	U1689	subsp. *dioica*	LR	0,578	4	1,1	1,4	4	N59.96352	E10.66717	326	NOR
	U1690	subsp. *dioica*	LR	0,578	4	1,1	1,4	4	N59.96352	E10.66717	326	NOR
UP0509	U1691	subsp. *dioica*	LR	0,572	4	1,3	1,5	4	N59.90117	E10.76604	44	NOR
	U1692	subsp. *dioica*	LR	0,572	4	1,3	1,5	4	N59.90117	E10.76604	44	NOR
	U1693	subsp. *dioica*	LR	0,572	4	1,3	1,5	4	N59.90117	E10.76604	44	NOR
	U1694	subsp. *dioica*	LR	0,572	4	1,3	1,5	4	N59.90117	E10.76604	44	NOR
UP0510	U1695	subsp. *dioica*	LR	0,571	4	1,4	1,6	6	N59.91865	E10.72833	31	NOR
	U1696	subsp. *dioica*	LR	0,571	4	1,4	1,6	6	N59.91865	E10.72833	31	NOR
	U1697	subsp. *dioica*	LR	0,571	4	1,4	1,6	6	N59.91865	E10.72833	31	NOR
	U1698	subsp. *dioica*	LR	0,571	4	1,4	1,6	6	N59.91865	E10.72833	31	NOR
	U1699	subsp. *dioica*	LR	0,571	4	1,4	1,6	6	N59.91865	E10.72833	31	NOR

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	U1700	subsp. *dioica*	LR	0,571	4	1,4	1,6	6	N59.91865	E10.72833	31	NOR
UP0511	U1701	subsp. *dioica*	LR	0,568	4	1,4	1,7	5	N59.89830	E10.72941	9	NOR
	U1702	subsp. *dioica*	LR	0,568	4	1,4	1,7	5	N59.89830	E10.72941	9	NOR
	U1703	subsp. *dioica*	LR	0,568	4	1,4	1,7	5	N59.89830	E10.72941	9	NOR
	U1704	subsp. *dioica*	LR	0,568	4	1,4	1,7	5	N59.89830	E10.72941	9	NOR
	U1705	subsp. *dioica*	LR	0,568	4	1,4	1,7	5	N59.89830	E10.72941	9	NOR
UP0512	U1706	subsp. *dioica*	LR	0,578	4	1,2	1,8	4	N59.89426	E10.72516	2	NOR
	U1707	subsp. *dioica*	LR	0,578	4	1,2	1,8	4	N59.89426	E10.72516	2	NOR
	U1708	subsp. *dioica*	LR	0,578	4	1,2	1,8	4	N59.89426	E10.72516	2	NOR
	U1709	subsp. *dioica*	LR	0,578	4	1,2	1,8	4	N59.89426	E10.72516	2	NOR
UP0513	U1715	subsp. *dioica*	IR	0,604	4	1,1	3,2	1	N43.63938	E11.16857	118	ITA
UP0514	U1716	subsp. *dioica*	IR	0,596	4	0,8	1,3	1	N43.69119	E11.20720	107	ITA
UP0515	U1725	subsp. *dioica*	JP	0,578	4	0,9	1,2	1	N35.85223	E52.07535	2370	IRN
UP0516	U1726	subsp. *dioica*	JP	0,578	4	0,8	1,3	1	N36.44307	E51.06507	1821	IRN
UP0517	U1727	subsp. *dioica*	JP	0,576	4	0,8	1,5	1	N36.47182	E51.09903	1569	IRN
UP0518	U1728	subsp. *dioica*	JP	0,566	4	0,9	1,3	1	N37.59830	E48.68333	2072	IRN
UP0519	U1742	subsp. *dioica*	JC, TU	0,565	4	1,1	2,5	1	N40.78980	E39.61565	451	TUR
	U1743	subsp. *dioica*	JC, TU	0,574	4	1,9	1,4	1	N40.78980	E39.61565	451	TUR
	U1744	subsp. *dioica*	JC, TU	0,575	4	0,9	2,6	1	N40.78980	E39.61565	451	TUR
	U1745	subsp. *dioica*	JC, TU	0,566	4	0,9	1,8	1	N40.78980	E39.61565	451	TUR
	U1746	subsp. *dioica*	JC, TU	0,562	4	1,1	1,5	1	N40.78980	E39.61565	451	TUR
UP0520	U1747	subsp. *dioica*	JC, TU	0,559	4	0,7	1,6	1	N40.69418	E39.45818	1380	TUR
	U1748	subsp. *dioica*	JC, TU	0,574	4	1,1	1,8	1	N40.69418	E39.45818	1380	TUR
	U1749	subsp. *dioica*	JC, TU	0,556	4	1,0	1,5	1	N40.69418	E39.45818	1380	TUR
	U1750	subsp. *dioica*	JC, TU	0,560	4	1,1	1,6	1	N40.69418	E39.45818	1380	TUR
UP0521	U1752	subsp. *dioica*	JC, TU	0,580	4	1,3	2,8	1	N40.64180	E39.40345	2060	TUR
	U1753	subsp. *dioica*	JC, TU	0,583	4	1,5	2,4	1	N40.64180	E39.40345	2060	TUR
	U1754	subsp. *dioica*	JC, TU	0,576	4	1,0	1,9	1	N40.64180	E39.40345	2060	TUR
	U1755	subsp. *dioica*	JC, TU	0,575	4	0,8	2,1	1	N40.64180	E39.40345	2060	TUR
	U1756	subsp. *dioica*	JC, TU	0,568	4	0,9	1,7	1	N40.64180	E39.40345	2060	TUR
	U1757	subsp. *dioica*	JC, TU	0,587	4	0,8	1,9	1	N40.64180	E39.40345	2060	TUR
UP0522	U1758	subsp. *dioica*	JC, TU	0,578	4	0,8	1,9	1	N40.23224	E39.44778	1710	TUR
	U1759	subsp. *dioica*	JC, TU	0,579	4	0,9	2,3	1	N40.23224	E39.44778	1710	TUR
UP0523	U1761	subsp. *dioica*	JC, TU	0,601	4	0,9	2,6	1	N40.07921	E38.77463	1165	TUR
	U1762	subsp. *dioica*	JC, TU	0,595	4	0,7	2,5	1	N40.07921	E38.77463	1165	TUR
	U1763	subsp. *dioica*	JC, TU	0,579	4	0,8	2,0	1	N40.07921	E38.77463	1165	TUR
UP0524	U1765	subsp. *dioica*	JC, TU	0,594	4	0,8	2,9	1	N39.85510	E38.39826	2080	TUR
UP0525	U1767	subsp. *kurdistanica*	JC, TU	0,316	2	1,3	1,8	1	N38.52032	E35.52553	2196	TUR
	U1768	subsp. *kurdistanica*	JC, TU	0,309	2	0,7	2,3	1	N38.52032	E35.52553	2196	TUR
	U1769	subsp. *kurdistanica*	JC, TU	0,319	2	0,9	3,8	1	N38.52032	E35.52553	2196	TUR
	U1770	subsp. *kurdistanica*	JC, TU	0,322	2	1,2	3,5	1	N38.52032	E35.52553	2196	TUR

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	U1771	subsp. *kurdistanica*	JC, TU	0,311	2	0,8	3,0	1	N38.52032	E35.52553	2196	TUR
UP0526	U1772	subsp. *kurdistanica*	JC, TU	0,300	2	1,2	2,4	1	N38.55548	E35.50371	2251	TUR
	U1773	subsp. *kurdistanica*	JC, TU	0,305	2	0,8	2,5	1	N38.55548	E35.50371	2251	TUR
	U1774	subsp. *kurdistanica*	JC, TU	0,304	2	1,1	2,2	1	N38.55548	E35.50371	2251	TUR
	U1775	subsp. *kurdistanica*	JC, TU	0,302	2	1,0	2,4	1	N38.55548	E35.50371	2251	TUR
	U1776	subsp. *kurdistanica*	JC, TU	0,304	2	1,6	2,3	1	N38.55548	E35.50371	2251	TUR
UP0527	U1777	subsp. *kurdistanica*	JC, TU	0,300	2	1,2	2,5	1	N37.35832	E34.69034	1765	TUR
	U1778	subsp. *kurdistanica*	JC, TU	0,302	2	1,1	2,2	1	N37.35832	E34.69034	1765	TUR
	U1779	subsp. *kurdistanica*	JC, TU	0,298	2	1,3	2,3	1	N37.35832	E34.69034	1765	TUR
	U1781	subsp. *kurdistanica*	JC, TU	0,298	2	0,7	2,2	1	N37.35832	E34.69034	1765	TUR
	U1782	subsp. *kurdistanica*	JC, TU	0,302	2	1,1	2,5	1	N37.35832	E34.69034	1765	TUR
UP0528	U1783	subsp. *subinermis*	JC, TU	0,321	2	1,0	3,4	1	N37.51418	E34.62849	1208	TUR
	U1784	subsp. *subinermis*	JC, TU	0,323	2	1,2	4,1	1	N37.51418	E34.62849	1208	TUR
	U1785	subsp. *subinermis*	JC, TU	0,317	2	0,8	2,9	1	N37.51418	E34.62849	1208	TUR
UP0529	U1786	subsp. *subinermis*	JC, TU	0,321	2	1,0	4,7	1	N38.71923	E37.35649	1250	TUR
	U1788	subsp. *subinermis*	JC, TU	0,316	2	0,7	3,4	1	N38.71923	E37.35649	1250	TUR
	U1789	subsp. *subinermis*	JC, TU	0,324	2	0,9	2,9	1	N38.71923	E37.35649	1250	TUR
UP0530	U1790	subsp. *dioica*	JC, TU	0,580	4	0,9	1,5	1	N39.01303	E40.70639	1195	TUR
	U1791	subsp. *dioica*	JC, TU	0,587	4	1,1	2,1	1	N39.01303	E40.70639	1195	TUR
	U1792	subsp. *dioica*	JC, TU	0,600	4	1,1	4,4	1	N39.01303	E40.70639	1195	TUR
	U1793	subsp. *dioica*	JC, TU	0,588	4	0,7	1,7	1	N39.01303	E40.70639	1195	TUR
UP0531	U1794	subsp. *dioica*	JC, TU	0,591	4	0,7	2,4	1	N39.65896	E41.04833	2142	TUR
	U1795	subsp. *dioica*	JC, TU	0,579	4	0,9	1,9	1	N39.65896	E41.04833	2142	TUR
	U1796	subsp. *dioica*	JC, TU	0,598	4	1,0	1,8	1	N39.65896	E41.04833	2142	TUR
UP0532	U1797	subsp. *dioica*	JC, TU	0,576	4	0,8	3,6	1	N40.11127	E40.98937	1938	TUR
UP0533	U1801	subsp. *dioica*	JC, TU	0,571	4	1,3	2,2	1	N40.17477	E40.97288	2322	TUR
	U1802	subsp. *dioica*	JC, TU	0,596	4	1,3	2,8	1	N40.17477	E40.97288	2322	TUR
UP0534	U1803	subsp. *dioica*	JC, TU	0,605	4	1,5	3,0	1	N40.34862	E40.78948	2380	TUR
UP0535	U1804	subsp. *dioica*	JC, TU	0,567	4	0,8	2,4	1	N40.62250	E40.78063	2740	TUR
	U1805	subsp. *dioica*	JC, TU	0,609	4	0,9	2,2	1	N40.62250	E40.78063	2740	TUR
	U1806	subsp. *dioica*	JC, TU	0,574	4	0,8	1,2	1	N40.62250	E40.78063	2740	TUR
	U1807	subsp. *dioica*	JC, TU	0,616	4	1,0	4,0	1	N40.62250	E40.78063	2740	TUR
UP0536	U1809	subsp. *dioica*	JC, TU	0,563	4	0,9	2,2	1	N40.70466	E40.65491	1492	TUR
UP0537	U1811	subsp. *dioica*	JC, TU	0,556	4	1,1	2,8	1	N40.75945	E40.59265	800	TUR
	U1812	subsp. *dioica*	JC, TU	0,570	4	1,0	2,2	1	N40.75945	E40.59265	800	TUR
	U1813	subsp. *dioica*	JC, TU	0,579	4	0,8	2,9	1	N40.75945	E40.59265	800	TUR
UP0538	U1814	subsp. *dioica*	JC, TU	0,578	4	0,9	2,0	1	N40.98679	E40.33489	8	TUR
	U1815	subsp. *dioica*	JC, TU	0,582	4	0,9	1,8	1	N40.98679	E40.33489	8	TUR
	U1816	subsp. *dioica*	JC, TU	0,596	4	0,9	2,9	1	N40.98679	E40.33489	8	TUR
UP0539	U1818	subsp. *dioica*	LR, SS	0,557	4	0,9	1,5	1	N64.07651	E20.88490	29	SWE
	U1819	subsp. *dioica*	LR, SS	0,557	4	0,9	1,5	1	N64.07651	E20.88490	29	SWE

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	U1820	subsp. *dioica*	LR, SS	0,557	4	0,9	1,5	1	N64.07651	E20.88490	29	SWE
	U1821	subsp. *dioica*	LR, SS	0,557	4	0,9	1,5	1	N64.07651	E20.88490	69	SWE
UP0540	U1823	subsp. *dioica*	LR, SS	0,559	4	0,8	2,6	1	N55.67270	E13.33271	69	SWE
	U1824	subsp. *dioica*	LR, SS	0,592	4	0,8	2,4	1	N55.67270	E13.33271	69	SWE
	U1825	subsp. *dioica*	LR, SS	0,563	4	0,9	2,4	1	N55.67270	E13.33271	69	SWE
	U1826	subsp. *dioica*	LR, SS	0,576	4	0,9	3,0	1	N55.67270	E13.33271	69	SWE
UP0541	U1828	subsp. *dioica*	LR, SS	0,571	4	1,2	1,6	1	N55.67540	E13.33463	66	SWE
	U1829	subsp. *dioica*	LR, SS	0,571	4	1,2	1,6	1	N55.67540	E13.33463	66	SWE
	U1830	subsp. *dioica*	LR, SS	0,571	4	1,2	1,6	1	N55.67540	E13.33463	66	SWE
	U1831	subsp. *dioica*	LR, SS	0,571	4	1,2	1,6	1	N55.67540	E13.33463	66	SWE
UP0542	U1832	subsp. *dioica*	LR, SS	0,590	4	1,6	1,3	1	N55.93731	E13.39284	63	SWE
	U1833	subsp. *dioica*	LR, SS	0,590	4	1,6	1,3	1	N55.93731	E13.39284	63	SWE
	U1834	subsp. *dioica*	LR, SS	0,590	4	1,6	1,3	1	N55.93731	E13.39284	63	SWE
	U1835	subsp. *dioica*	LR, SS	0,590	4	1,6	1,3	1	N55.93731	E13.39284	63	SWE
UP0543	U1837	subsp. *dioica*	LR, SS	0,572	4	1,2	1,7	1	N56.03463	E13.34168	40	SWE
	U1838	subsp. *dioica*	LR, SS	0,572	4	1,2	1,7	1	N56.03463	E13.34168	40	SWE
	U1839	subsp. *dioica*	LR, SS	0,572	4	1,2	1,7	1	N56.03463	E13.34168	40	SWE
	U1840	subsp. *dioica*	LR, SS	0,572	4	1,2	1,7	1	N56.03463	E13.34168	40	SWE
	U1841	subsp. *dioica*	LR, SS	0,572	4	1,2	1,7	1	N56.03463	E13.34168	40	SWE
	U1842	subsp. *dioica*	LR, SS	0,572	4	1,2	1,7	1	N56.03463	E13.34168	40	SWE
UP0544	U1845	subsp. *dioica*	LR, SS	0,569	4	1,7	1,9	4	N56.88250	E14.56061	164	SWE
	U1846	subsp. *dioica*	LR, SS	0,569	4	1,7	1,9	4	N56.88250	E14.56061	164	SWE
	U1847	subsp. *dioica*	LR, SS	0,569	4	1,7	1,9	4	N56.88250	E14.56061	164	SWE
	U1848	subsp. *dioica*	LR, SS	0,569	4	1,7	1,9	4	N56.88250	E14.56061	164	SWE
UP0545	U1849	subsp. *dioica*	LR, SS	0,580	4	1,9	1,6	1	N57.10716	E14.16966	153	SWE
	U1850	subsp. *dioica*	LR, SS	0,580	4	1,9	1,6	1	N57.10716	E14.16966	153	SWE
	U1851	subsp. *dioica*	LR, SS	0,580	4	1,9	1,6	1	N57.10716	E14.16966	153	SWE
	U1852	subsp. *dioica*	LR, SS	0,580	4	1,9	1,6	1	N57.10716	E14.16966	153	SWE
UP0546	U1854	subsp. *dioica*	LR, SS	0,564	4	0,9	2,4	1	N57.28708	E13.93266	174	SWE
	U1856	subsp. *dioica*	LR, SS	0,564	4	0,9	2,4	1	N57.28708	E13.93266	174	SWE
	U1857	subsp. *dioica*	LR, SS	0,564	4	0,9	2,4	1	N57.28708	E13.93266	174	SWE
	U1858	subsp. *dioica*	LR, SS	0,564	4	0,9	2,4	1	N57.28708	E13.93266	174	SWE
UP0547	U1860	subsp. *dioica*	LR, SS	0,608	4	0,8	2,3	1	N57.35338	E13.93296	166	SWE
	U1861	subsp. *dioica*	LR, SS	0,588	4	0,9	1,9	1	N57.35338	E13.93296	166	SWE
	U1862	subsp. *dioica*	LR, SS	0,610	4	0,9	2,1	1	N57.35338	E13.93296	166	SWE
	U1863	subsp. *dioica*	LR, SS	0,583	4	0,9	1,5	1	N57.35338	E13.93296	166	SWE
UP0548	U1865	subsp. *dioica*	LR, SS	0,559	4	1,5	1,7	4	N58.36045	E14.35256	138	SWE
	U1866	subsp. *dioica*	LR, SS	0,559	4	1,5	1,7	4	N58.36045	E14.35256	138	SWE
	U1867	subsp. *dioica*	LR, SS	0,559	4	1,5	1,7	4	N58.36045	E14.35256	138	SWE
	U1868	subsp. *dioica*	LR, SS	0,559	4	1,5	1,7	4	N58.36045	E14.35256	138	SWE
UP0549	U1870	subsp. *dioica*	LR, SS	0,582	4	1,1	1,8	4	N58.67096	E14.61750	114	SWE

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	U1871	subsp. *dioica*	LR, SS	0,582	4	1,1	1,8	4	N58.67096	E14.61750	114	SWE
	U1872	subsp. *dioica*	LR, SS	0,582	4	1,1	1,8	4	N58.67096	E14.61750	114	SWE
	U1873	subsp. *dioica*	LR, SS	0,582	4	1,1	1,8	4	N58.67096	E14.61750	114	SWE
UP0550	U1876	subsp. *dioica*	LR, SS	0,591	4	1,0	2,4	1	N58.71581	E14.59296	183	SWE
UP0551	U1877	subsp. *dioica*	LR, SS	0,584	4	0,8	1,9	1	N59.02181	E14.59265	106	SWE
	U1878	subsp. *dioica*	LR, SS	0,584	4	0,8	1,9	1	N59.02181	E14.59265	106	SWE
	U1879	subsp. *dioica*	LR, SS	0,584	4	0,8	1,9	1	N59.02181	E14.59265	106	SWE
	U1880	subsp. *dioica*	LR, SS	0,584	4	0,8	1,9	1	N59.02181	E14.59265	106	SWE
UP0552	U1882	subsp. *dioica*	LR, SS	0,577	4	0,8	1,9	1	N59.54798	E14.28916	130	SWE
	U1884	subsp. *dioica*	LR, SS	0,567	4	1,0	3,1	1	N59.54798	E14.28916	130	SWE
UP0553	U1885	subsp. *dioica*	LR, SS	0,581	4	1,2	2,7	1	N60.51391	E14.23883	254	SWE
	U1886	subsp. *dioica*	LR, SS	0,585	4	1,3	2,3	4	N60.51391	E14.23883	254	SWE
	U1887	subsp. *dioica*	LR, SS	0,585	4	1,3	2,3	4	N60.51391	E14.23883	254	SWE
	U1888	subsp. *dioica*	LR, SS	0,585	4	1,3	2,3	4	N60.51391	E14.23883	254	SWE
	U1889	subsp. *dioica*	LR, SS	0,585	4	1,3	2,3	4	N60.51391	E14.23883	254	SWE
UP0554	U1890	subsp. *dioica*	LR, SS	0,603	4	0,9	2,6	1	N60.82551	E14.12665	283	SWE
	U1891	subsp. *dioica*	LR, SS	0,574	4	0,8	1,5	3	N60.82551	E14.12665	283	SWE
	U1892	subsp. *dioica*	LR, SS	0,574	4	0,8	1,5	3	N60.82551	E14.12665	283	SWE
	U1893	subsp. *dioica*	LR, SS	0,574	4	0,8	1,5	3	N60.82551	E14.12665	283	SWE
UP0555	U1896	subsp. *dioica*	LR, SS	0,593	4	0,9	2,4	1	N60.96453	E13.89091	284	SWE
	U1897	subsp. *dioica*	LR, SS	0,565	4	0,9	1,5	4	N60.96453	E13.89091	284	SWE
	U1898	subsp. *dioica*	LR, SS	0,565	4	0,9	1,5	4	N60.96453	E13.89091	284	SWE
	U1899	subsp. *dioica*	LR, SS	0,565	4	0,9	1,5	4	N60.96453	E13.89091	284	SWE
	U1900	subsp. *dioica*	LR, SS	0,596	4	0,7	2,0	1	N60.96453	E13.89091	284	SWE
	U1901	subsp. *dioica*	LR, SS	0,565	4	0,9	1,5	4	N60.96453	E13.89091	284	SWE
UP0556	U1903	subsp. *dioica*	LR, SS	0,573	4	1,4	1,6	1	N61.28001	E13.76493	267	SWE
	U1904	subsp. *dioica*	LR, SS	0,573	4	1,4	1,6	1	N61.28001	E13.76493	267	SWE
	U1905	subsp. *dioica*	LR, SS	0,573	4	1,4	1,6	1	N61.28001	E13.76493	267	SWE
	U1906	subsp. *dioica*	LR, SS	0,573	4	1,4	1,6	1	N61.28001	E13.76493	267	SWE
UP0557	U1907	subsp. *dioica*	LR, SS	0,598	4	1,9	3,8	1	N61.69381	E13.14653	442	SWE
	U1908	subsp. *dioica*	LR, SS	0,567	4	1,4	1,2	3	N61.69381	E13.14653	442	SWE
	U1909	subsp. *dioica*	LR, SS	0,567	4	1,4	1,2	3	N61.69381	E13.14653	442	SWE
	U1910	subsp. *dioica*	LR, SS	0,567	4	1,4	1,2	3	N61.69381	E13.14653	442	SWE
UP0558	U1913	subsp. *dioica*	LR, SS	0,572	4	0,9	1,4	1	N61.84621	E14.05050	467	SWE
	U1914	subsp. *dioica*	LR, SS	0,572	4	0,9	1,4	1	N61.84621	E14.05050	467	SWE
	U1915	subsp. *dioica*	LR, SS	0,572	4	0,9	1,4	1	N61.84621	E14.05050	467	SWE
	U1916	subsp. *dioica*	LR, SS	0,572	4	0,9	1,4	1	N61.84621	E14.05050	467	SWE
UP0559	U1918	subsp. *dioica*	LR, SS	0,568	4	1,3	1,6	4	N62.04211	E14.67931	350	SWE
	U1919	subsp. *dioica*	LR, SS	0,568	4	1,3	1,6	4	N62.04211	E14.67931	350	SWE
	U1920	subsp. *dioica*	LR, SS	0,568	4	1,3	1,6	4	N62.04211	E14.67931	350	SWE
	U1921	subsp. *dioica*	LR, SS	0,568	4	1,3	1,6	4	N62.04211	E14.67931	350	SWE

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UP0560	U1923	subsp. *dioica*	LR, SS	0,572	4	0,9	1,6	1	N62.17363	E14.94276	270	SWE
	U1924	subsp. *dioica*	LR, SS	0,572	4	0,9	1,6	1	N62.17363	E14.94276	270	SWE
	U1925	subsp. *dioica*	LR, SS	0,572	4	0,9	1,6	1	N62.17363	E14.94276	270	SWE
	U1926	subsp. *dioica*	LR, SS	0,572	4	0,9	1,6	1	N62.17363	E14.94276	270	SWE
UP0561	U1928	subsp. *dioica*	LR, SS	0,585	4	1,6	1,2	1	N62.78120	E14.43401	295	SWE
	U1929	subsp. *dioica*	LR, SS	0,585	4	1,6	1,2	1	N62.78120	E14.43401	295	SWE
	U1930	subsp. *dioica*	LR, SS	0,585	4	1,6	1,2	1	N62.78120	E14.43401	295	SWE
	U1931	subsp. *dioica*	LR, SS	0,585	4	1,6	1,2	1	N62.78120	E14.43401	295	SWE
	U1932	subsp. *dioica*	LR, SS	0,585	4	1,6	1,2	1	N62.78120	E14.43401	295	SWE
UP0562	U1933	subsp. *dioica*	LR, SS	0,576	4	1,0	1,8	5	N63.20056	E13.95024	363	SWE
	U1934	subsp. *dioica*	LR, SS	0,576	4	1,0	1,8	5	N63.20056	E13.95024	363	SWE
	U1935	subsp. *dioica*	LR, SS	0,576	4	1,0	1,8	5	N63.20056	E13.95024	363	SWE
	U1937	subsp. *dioica*	LR, SS	0,576	4	1,0	1,8	5	N63.20056	E13.95024	363	SWE
	U1938	subsp. *dioica*	LR, SS	0,576	4	1,0	1,8	5	N63.20056	E13.95024	363	SWE
UP0563	U1939	subsp. *dioica*	LR, SS	0,571	4	1,2	1,6	5	N63.22173	E13.92875	362	SWE
	U1940	subsp. *dioica*	LR, SS	0,571	4	1,2	1,6	5	N63.22173	E13.92875	362	SWE
	U1941	subsp. *dioica*	LR, SS	0,571	4	1,2	1,6	5	N63.22173	E13.92875	362	SWE
	U1942	subsp. *dioica*	LR, SS	0,571	4	1,2	1,6	5	N63.22173	E13.92875	362	SWE
	U1943	subsp. *dioica*	LR, SS	0,571	4	1,2	1,6	5	N63.22173	E13.92875	362	SWE
	U1945	subsp. *dioica*	LR, SS	0,598	4	1,0	2,9	1	N63.22173	E13.92875	362	SWE
	U1946	subsp. *dioica*	LR, SS	0,583	4	1,2	3,5	1	N63.22173	E13.92875	362	SWE
	U1947	subsp. *dioica*	LR, SS	0,614	4	1,0	3,5	1	N63.22173	E13.92875	362	SWE
	U1948	subsp. *dioica*	LR, SS	0,594	4	1,9	2,3	1	N63.22173	E13.92875	362	SWE
UP0564	U1950	subsp. *dioica*	LR, SS	0,576	4	0,7	1,2	4	N63.19455	E15.13136	309	SWE
	U1951	subsp. *dioica*	LR, SS	0,576	4	0,7	1,2	4	N63.19455	E15.13136	309	SWE
	U1952	subsp. *dioica*	LR, SS	0,576	4	0,7	1,2	4	N63.19455	E15.13136	309	SWE
	U1953	subsp. *dioica*	LR, SS	0,576	4	0,7	1,2	4	N63.19455	E15.13136	309	SWE
UP0565	U1954	subsp. *dioica*	LR, SS	0,593	4	1,1	3,7	1	N62.95636	E16.67799	111	SWE
	U1956	subsp. *dioica*	LR, SS	0,598	4	1,2	3,1	1	N62.95636	E16.67799	111	SWE
	U1957	subsp. *dioica*	LR, SS	0,617	4	1,0	3,1	1	N62.95636	E16.67799	111	SWE
UP0566	U1959	subsp. *dioica*	LR, SS	0,582	4	0,7	2,2	1	N63.14806	E17.76411	23	SWE
	U1960	subsp. *dioica*	LR, SS	0,584	4	0,9	3,3	1	N63.14806	E17.76411	23	SWE
	U1962	subsp. *dioica*	LR, SS	0,585	4	1,4	2,2	1	N63.14806	E17.76411	23	SWE
	U1963	subsp. *dioica*	LR, SS	0,584	4	0,9	1,6	1	N63.14806	E17.76411	23	SWE
UP0567	U1964	subsp. *dioica*	LR, SS	0,608	4	0,7	2,5	1	N63.28958	E18.64225	1	SWE
	U1965	subsp. *dioica*	LR, SS	0,575	4	0,8	1,4	1	N63.28958	E18.64225	1	SWE
	U1966	subsp. *dioica*	LR, SS	0,575	4	0,8	1,4	1	N63.28958	E18.64225	1	SWE
	U1967	subsp. *dioica*	LR, SS	0,575	4	0,8	1,4	1	N63.28958	E18.64225	1	SWE
	U1968	subsp. *dioica*	LR, SS	0,575	4	0,8	1,4	1	N63.28958	E18.64225	1	SWE
UP0568	U1969	subsp. *dioica*	LR, SS	0,578	4	0,9	1,1	3	N64.06273	E20.86291	16	SWE
	U1970	subsp. *dioica*	LR, SS	0,578	4	0,9	1,1	3	N64.06273	E20.86291	16	SWE

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	U1972	subsp. *dioica*	LR, SS	0,622	4	0,8	3,5	1	N64.06273	E20.86291	16	SWE
	U1973	subsp. *dioica*	LR, SS	0,578	4	0,9	1,1	3	N64.06273	E20.86291	16	SWE
UP0569	U1974	subsp. *dioica*	LR, SS	0,578	4	1,5	1,7	1	N64.53873	E21.25659	64	SWE
	U1975	subsp. *dioica*	LR, SS	0,578	4	1,5	1,7	1	N64.53873	E21.25659	64	SWE
	U1976	subsp. *dioica*	LR, SS	0,578	4	1,5	1,7	1	N64.53873	E21.25659	64	SWE
	U1977	subsp. *dioica*	LR, SS	0,578	4	1,5	1,7	1	N64.53873	E21.25659	64	SWE
UP0570	U1980	subsp. *dioica*	LR, SS	0,563	4	1,2	1,7	1	N65.14340	E21.50853	24	SWE
	U1981	subsp. *dioica*	LR, SS	0,563	4	1,2	1,7	1	N65.14340	E21.50853	24	SWE
	U1982	subsp. *dioica*	LR, SS	0,563	4	1,2	1,7	1	N65.14340	E21.50853	24	SWE
	U1983	subsp. *dioica*	LR, SS	0,563	4	1,2	1,7	1	N65.14340	E21.50853	24	SWE
UP0571	U1985	subsp. *dioica*	LR, SS	0,572	4	0,9	1,5	1	N65.37790	E21.29759	24	SWE
	U1986	subsp. *dioica*	LR, SS	0,572	4	0,9	1,5	1	N65.37790	E21.29759	24	SWE
	U1987	subsp. *dioica*	LR, SS	0,572	4	0,9	1,5	1	N65.37790	E21.29759	24	SWE
	U1988	subsp. *dioica*	LR, SS	0,572	4	0,9	1,5	1	N65.37790	E21.29759	24	SWE
UP0572	U1989	subsp. *dioica*	LR, SS	0,572	4	1,1	1,4	1	N65.35451	E21.58293	10	SWE
	U1990	subsp. *dioica*	LR, SS	0,572	4	1,1	1,4	1	N65.35451	E21.58293	10	SWE
	U1991	subsp. *dioica*	LR, SS	0,572	4	1,1	1,4	1	N65.35451	E21.58293	10	SWE
	U1992	subsp. *dioica*	LR, SS	0,572	4	1,1	1,4	1	N65.35451	E21.58293	10	SWE
	U1993	subsp. *dioica*	LR, SS	0,572	4	1,1	1,4	1	N65.35451	E21.58293	10	SWE
UP0573	U1994	subsp. *dioica*	LR, SS	0,567	4	1,9	1,7	1	N65.88580	E22.95945	55	SWE
	U1995	subsp. *dioica*	LR, SS	0,567	4	1,9	1,7	1	N65.88580	E22.95945	55	SWE
	U1997	subsp. *dioica*	LR, SS	0,567	4	1,9	1,7	1	N65.88580	E22.95945	55	SWE
	U1998	subsp. *dioica*	LR, SS	0,567	4	1,9	1,7	1	N65.88580	E22.95945	55	SWE
UP0574	U1999	subsp. *dioica*	LR, SS	0,574	4	0,9	1,3	1	N65.71911	E23.07973	63	SWE
	U2000	subsp. *dioica*	LR, SS	0,574	4	0,9	1,3	1	N65.71911	E23.07973	63	SWE
	U2001	subsp. *dioica*	LR, SS	0,574	4	0,9	1,3	1	N65.71911	E23.07973	63	SWE
	U2002	subsp. *dioica*	LR, SS	0,574	4	0,9	1,3	1	N65.71911	E23.07973	63	SWE
	U2003	subsp. *dioica*	LR, SS	0,574	4	0,9	1,3	1	N65.71911	E23.07973	63	SWE
UP0575	U2005	subsp. *dioica*	LR, SS	0,571	4	0,9	1,8	3	N66.14780	E23.92623	44	FIN
	U2006	subsp. *dioica*	LR, SS	0,571	4	0,9	1,8	3	N66.14780	E23.92623	44	FIN
	U2007	subsp. *dioica*	LR, SS	0,571	4	0,9	1,8	3	N66.14780	E23.92623	44	FIN
	U2008	subsp. *dioica*	LR, SS	0,575	4	1,3	1,6	4	N66.14780	E23.92623	44	FIN
	U2009	subsp. *dioica*	LR, SS	0,575	4	1,3	1,6	4	N66.14780	E23.92623	44	FIN
	U2010	subsp. *dioica*	LR, SS	0,575	4	1,3	1,6	4	N66.14780	E23.92623	44	FIN
	U2011	subsp. *dioica*	LR, SS	0,575	4	1,3	1,6	4	N66.14780	E23.92623	44	FIN
	U2013	subsp. *dioica*	LR, SS	0,573	4	1,2	1,6	4	N66.14780	E23.92623	44	FIN
	U2014	subsp. *dioica*	LR, SS	0,573	4	1,2	1,6	4	N66.14780	E23.92623	44	FIN
	U2015	subsp. *dioica*	LR, SS	0,573	4	1,2	1,6	4	N66.14780	E23.92623	44	FIN
	U2016	subsp. *dioica*	LR, SS	0,573	4	1,2	1,6	4	N66.14780	E23.92623	44	FIN
UP0576	U2018	subsp. *dioica*	LR, SS	0,587	4	1,9	2,5	1	N66.21545	E23.71080	45	SWE
	U2019	subsp. *dioica*	LR, SS	0,587	4	1,9	2,5	1	N66.21545	E23.71080	45	SWE

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	U2021	subsp. *dioica*	LR, SS	0,587	4	1,9	2,5	1	N66.21545	E23.71080	45	SWE
	U2022	subsp. *dioica*	LR, SS	0,587	4	1,9	2,5	1	N66.21545	E23.71080	45	SWE
	U2023	subsp. *dioica*	LR, SS	0,587	4	1,9	2,5	1	N66.21545	E23.71080	45	SWE
	U2024	subsp. *dioica*	LR, SS	0,587	4	1,9	2,5	1	N66.21545	E23.71080	45	SWE
UP0577	U2025	subsp. *dioica*	LR, SS	0,598	4	0,9	3,4	1	N66.56066	E23.83698	104	SWE
	U2026	subsp. *dioica*	LR, SS	0,615	4	0,9	3,3	1	N66.56066	E23.83698	104	SWE
	U2028	subsp. *dioica*	LR, SS	0,600	4	1,2	2,1	1	N66.56066	E23.83698	104	SWE
UP0578	U2030	subsp. *dioica*	LR, SS	0,588	4	0,8	1,5	1	N66.45353	E22.39183	88	SWE
	U2031	subsp. *dioica*	LR, SS	0,601	4	0,7	3,2	1	N66.45353	E22.39183	88	SWE
	U2032	subsp. *dioica*	LR, SS	0,591	4	0,8	2,4	1	N66.45353	E22.39183	88	SWE
	U2033	subsp. *dioica*	LR, SS	0,571	4	1,0	2,4	1	N66.45353	E22.39183	88	SWE
	U2034	subsp. *dioica*	LR, SS	0,624	4	1,3	2,7	1	N66.45353	E22.39183	88	SWE
UP0579	U2036	subsp. *dioica*	LR, SS	0,595	4	1,0	2,3	1	N68.43923	E22.46148	313	SWE
	U2037	subsp. *dioica*	LR, SS	0,606	4	1,0	2,9	1	N68.43923	E22.46148	313	SWE
	U2038	subsp. *dioica*	LR, SS	0,602	4	0,9	2,2	1	N68.43923	E22.46148	313	SWE
	U2039	subsp. *dioica*	LR, SS	0,599	4	0,9	1,9	1	N68.43923	E22.46148	313	SWE
UP0580	U2041	subsp. *sondenii*	LR, SS	0,306	2	1,0	2,6	1	N68.48526	E22.29748	328	FIN
	U2043	subsp. *sondenii*	LR, SS	0,308	2	0,9	3,4	1	N68.48526	E22.29748	328	FIN
	U2044	subsp. *sondenii*	LR, SS	0,312	2	0,8	3,5	1	N68.48526	E22.29748	328	FIN
UP0581	U2045	subsp. *dioica*	LR, SS	0,590	4	1,2	3,9	1	N69.92744	E23.27426	13	NOR
	U2046	subsp. *dioica*	LR, SS	0,593	4	0,9	2,6	1	N69.92744	E23.27426	13	NOR
	U2047	subsp. *dioica*	LR, SS	0,584	4	1,0	2,2	1	N69.92744	E23.27426	13	NOR
	U2048	subsp. *dioica*	LR, SS	0,598	4	0,9	1,7	1	N69.92744	E23.27426	13	NOR
	U2049	subsp. *dioica*	LR, SS	0,631	4	0,9	2,6	1	N69.92744	E23.27426	13	NOR
	U2050	subsp. *dioica*	LR, SS	0,608	4	0,8	1,3	1	N69.92744	E23.27426	13	NOR
	U2051	subsp. *dioica*	LR, SS	0,593	4	1,2	1,5	1	N69.92744	E23.27426	13	NOR
	U2052	subsp. *dioica*	LR, SS	0,606	4	1,1	2,7	1	N69.92744	E23.27426	13	NOR
	U2053	subsp. *dioica*	LR, SS	0,581	4	1,0	2,4	1	N69.92744	E23.27426	13	NOR
	U2054	subsp. *dioica*	LR, SS	0,584	4	1,1	1,9	1	N69.92744	E23.27426	13	NOR
UP0582	U2055	subsp. *sondenii*	LR, SS	0,322	2	0,8	3,5	1	N70.51665	E25.07363	13	NOR
	U2056	subsp. *sondenii*	LR, SS	0,294	2	1,2	2,1	1	N70.51665	E25.07363	13	NOR
	U2058	subsp. *sondenii*	LR, SS	0,301	2	1,3	2,6	1	N70.51665	E25.07363	13	NOR
	U2059	subsp. *sondenii*	LR, SS	0,308	2	0,8	3,0	1	N70.51665	E25.07363	13	NOR
	U2060	subsp. *sondenii*	LR, SS	0,306	2	1,0	2,5	1	N70.51665	E25.07363	13	NOR
UP0583	U2061	subsp. *dioica*	LR, SS	0,603	4	1,0	2,4	1	N70.03428	E24.97239	47	NOR
	U2062	subsp. *sondenii*	LR, SS	0,326	2	1,6	3,6	1	N70.03428	E24.97239	47	NOR
	U2063	subsp. *sondenii*	LR, SS	0,315	2	0,8	2,6	1	N70.03428	E24.97239	47	NOR
	U2064	subsp. *dioica*	LR, SS	0,616	4	0,9	2,3	1	N70.03428	E24.97239	47	NOR
	U2065	subsp. *dioica*	LR, SS	0,603	4	1,3	2,8	1	N70.03428	E24.97239	47	NOR
	U2066	subsp. *dioica*	LR, SS	0,584	4	1,0	1,4	1	N70.03428	E24.97239	47	NOR
	U2067	subsp. *dioica*	LR, SS	0,595	4	0,9	1,8	1	N70.03428	E24.97239	47	NOR

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	U2068	subsp. *dioica*	LR, SS	0,579	4	0,7	2,8	1	N70.03428	E24.97239	47	NOR
	U2069	subsp. *dioica*	LR, SS	0,620	4	0,9	2,1	1	N70.03428	E24.97239	47	NOR
	U2070	subsp. *dioica*	LR, SS	0,592	4	1,1	3,3	1	N70.03428	E24.97239	47	NOR
UP0584	U2072	subsp. *sondenii*	LR, SS	0,297	2	1,3	1,9	1	N67.83978	E26.72058	182	FIN
	U2073	subsp. *sondenii*	LR, SS	0,299	2	0,9	2,8	1	N67.83978	E26.72058	182	FIN
	U2074	subsp. *sondenii*	LR, SS	0,311	2	1,0	3,7	1	N67.83978	E26.72058	182	FIN
	U2075	subsp. *sondenii*	LR, SS	0,311	2	1,5	3,3	1	N67.83978	E26.72058	182	FIN
	U2076	subsp. *sondenii*	LR, SS	0,302	2	1,3	2,3	1	N67.83978	E26.72058	182	FIN
UP0585	U2078	subsp. *dioica*	LR, SS	0,587	4	1,1	1,7	4	N66.53263	E25.71350	70	FIN
	U2079	subsp. *dioica*	LR, SS	0,587	4	1,1	1,7	4	N66.53263	E25.71350	70	FIN
	U2080	subsp. *dioica*	LR, SS	0,587	4	1,1	1,7	4	N66.53263	E25.71350	70	FIN
	U2081	subsp. *dioica*	LR, SS	0,587	4	1,1	1,7	4	N66.53263	E25.71350	70	FIN
UP0586	U2083	subsp. *dioica*	LR, SS	0,570	4	0,9	1,6	3	N65.99875	E26.21096	141	FIN
	U2084	subsp. *dioica*	LR, SS	0,570	4	0,9	1,6	3	N65.99875	E26.21096	141	FIN
	U2085	subsp. *dioica*	LR, SS	0,570	4	0,9	1,6	3	N65.99875	E26.21096	141	FIN
UP0587	U2087	subsp. *dioica*	LR, SS	0,554	4	1,4	2,4	5	N65.32458	E25.37945	13	FIN
	U2088	subsp. *dioica*	LR, SS	0,554	4	1,4	2,4	5	N65.32458	E25.37945	13	FIN
	U2089	subsp. *dioica*	LR, SS	0,554	4	1,4	2,4	5	N65.32458	E25.37945	13	FIN
	U2090	subsp. *dioica*	LR, SS	0,554	4	1,4	2,4	5	N65.32458	E25.37945	13	FIN
	U2091	subsp. *dioica*	LR, SS	0,554	4	1,4	2,4	5	N65.32458	E25.37945	13	FIN
UP0588	U2092	subsp. *dioica*	LR, SS	0,573	4	1,0	1,4	4	N64.84421	E25.17436	7	FIN
	U2093	subsp. *dioica*	LR, SS	0,604	4	0,9	3,4	1	N64.84421	E25.17436	7	FIN
	U2094	subsp. *dioica*	LR, SS	0,573	4	1,0	1,4	4	N64.84421	E25.17436	7	FIN
	U2095	subsp. *dioica*	LR, SS	0,573	4	1,0	1,4	4	N64.84421	E25.17436	7	FIN
	U2096	subsp. *dioica*	LR, SS	0,573	4	1,0	1,4	4	N64.84421	E25.17436	7	FIN
UP0589	U2098	subsp. *dioica*	LR, SS	0,586	4	1,1	1,6	3	N64.85576	E24.72666	91	FIN
	U2099	subsp. *dioica*	LR, SS	0,589	4	1,0	2,6	1	N64.85576	E24.72666	91	FIN
	U2100	subsp. *dioica*	LR, SS	0,586	4	1,1	1,6	3	N64.85576	E24.72666	91	FIN
	U2101	subsp. *dioica*	LR, SS	0,608	4	0,9	2,4	1	N64.85576	E24.72666	91	FIN
UP0590	U2102	subsp. *dioica*	LR, SS	0,611	4	1,0	2,7	1	N64.46155	E24.23703	53	FIN
	U2103	subsp. *dioica*	LR, SS	0,587	4	1,0	2,0	1	N64.46155	E24.23703	53	FIN
	U2104	subsp. *dioica*	LR, SS	0,573	4	0,8	1,7	1	N64.46155	E24.23703	53	FIN
	U2105	subsp. *dioica*	LR, SS	0,585	4	0,9	2,4	1	N64.46155	E24.23703	53	FIN
UP0591	U2108	subsp. *dioica*	LR, SS	0,589	4	1,0	2,0	1	N64.28918	E23.91998	48	FIN
	U2109	subsp. *subinermis*	LR, SS	0,302	2	1,3	2,5	1	N64.28918	E23.91998	48	FIN
	U2110	subsp. *dioica*	LR, SS	0,580	4	0,9	1,3	1	N64.28918	E23.91998	48	FIN
	U2111	subsp. *dioica*	LR, SS	0,583	4	1,2	1,7	1	N64.28918	E23.91998	48	FIN
	U2112	subsp. *dioica*	LR, SS	0,571	4	1,1	1,2	1	N64.28918	E23.91998	48	FIN
	U2113	subsp. *dioica*	LR, SS	0,572	4	1,7	1,5	1	N64.28918	E23.91998	48	FIN
	U2114	subsp. *dioica*	LR, SS	0,571	4	1,3	1,5	1	N64.28918	E23.91998	48	FIN
	U2115	subsp. *dioica*	LR, SS	0,577	4	1,5	1,5	1	N64.28918	E23.91998	48	FIN

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UP0592	U2117	subsp. *subinermis*	LR, SS	0,301	2	0,8	1,8	1	N63.90906	E25.00998	84	FIN
	U2118	subsp. *subinermis*	LR, SS	0,297	2	1,6	1,8	1	N63.90906	E25.00998	84	FIN
	U2119	subsp. *subinermis*	LR, SS	0,299	2	0,7	1,6	1	N63.90906	E25.00998	84	FIN
	U2120	subsp. *subinermis*	LR, SS	0,299	2	0,9	1,8	1	N63.90906	E25.00998	84	FIN
UP0593	U2122	subsp. *subinermis*	LR, SS	0,297	2	0,8	1,7	2	N63.59490	E27.16149	93	FIN
	U2123	subsp. *subinermis*	LR, SS	0,297	2	0,8	1,7	2	N63.59490	E27.16149	93	FIN
	U2124	subsp. *subinermis*	LR, SS	0,297	2	1,7	1,7	2	N63.59490	E27.16149	93	FIN
	U2125	subsp. *subinermis*	LR, SS	0,297	2	1,7	1,7	2	N63.59490	E27.16149	93	FIN
UP0594	U2126	subsp. *subinermis*	LR, SS	0,297	2	1,3	1,8	2	N62.16090	E28.15618	91	FIN
	U2127	subsp. *subinermis*	LR, SS	0,318	2	0,9	4,0	1	N62.16090	E28.15618	91	FIN
	U2128	subsp. *subinermis*	LR, SS	0,297	2	1,3	1,8	2	N62.16090	E28.15618	91	FIN
	U2130	subsp. *subinermis*	LR, SS	0,300	2	1,9	2,7	2	N62.16090	E28.15618	91	FIN
	U2131	subsp. *subinermis*	LR, SS	0,300	2	1,9	2,7	2	N62.16090	E28.15618	91	FIN
UP0595	U2133	subsp. *subinermis*	LR, SS	0,306	2	0,9	3,7	2	N61.84828	E29.17859	129	FIN
	U2134	subsp. *subinermis*	LR, SS	0,306	2	0,9	3,7	2	N61.84828	E29.17859	129	FIN
UP0596	U2136	subsp. *subinermis*	LR, SS	0,293	2	1,1	2,7	1	N61.48451	E29.48244	88	FIN
	U2137	subsp. *subinermis*	LR, SS	0,294	2	0,9	2,4	1	N61.48451	E29.48244	88	FIN
	U2138	subsp. *subinermis*	LR, SS	0,299	2	0,8	2,4	1	N61.48451	E29.48244	88	FIN
	U2139	subsp. *subinermis*	LR, SS	0,297	2	0,9	1,9	1	N61.48451	E29.48244	88	FIN
UP0597	U2140	subsp. *subinermis*	LR, SS	0,306	2	0,8	2,6	1	N61.86335	E29.28756	74	FIN
	U2141	subsp. *subinermis*	LR, SS	0,302	2	1,3	2,0	2	N61.86335	E29.28756	74	FIN
	U2142	subsp. *subinermis*	LR, SS	0,302	2	1,3	2,0	2	N61.86335	E29.28756	74	FIN
	U2143	subsp. *subinermis*	LR, SS	0,296	2	0,8	2,1	2	N61.86335	E29.28756	74	FIN
	U2144	subsp. *subinermis*	LR, SS	0,296	2	0,8	2,1	2	N61.86335	E29.28756	74	FIN
UP0598	U2145	subsp. *subinermis*	LR, SS	0,299	2	1,0	2,6	1	N62.06351	E27.56121	127	FIN
	U2147	subsp. *subinermis*	LR, SS	0,298	2	1,0	2,2	1	N62.06351	E27.56121	127	FIN
UP0599	U2148	subsp. *subinermis*	LR, SS	0,302	2	1,1	3,2	1	N62.39703	E26.42971	99	FIN
	U2149	subsp. *subinermis*	LR, SS	0,308	2	1,3	3,4	1	N62.39703	E26.42971	99	FIN
	U2150	subsp. *subinermis*	LR, SS	0,295	2	0,9	2,3	1	N62.39703	E26.42971	99	FIN
UP0600	U2152	subsp. *subinermis*	LR, SS	0,302	2	0,8	2,1	1	N62.90926	E24.82408	150	FIN
	U2153	subsp. *subinermis*	LR, SS	0,297	2	0,8	1,7	1	N62.90926	E24.82408	150	FIN
UP0601	U2155	subsp. *dioica*	LR, SS	0,574	4	0,9	2,1	3	N63.03061	E23.83238	127	FIN
	U2156	subsp. *dioica*	LR, SS	0,574	4	0,9	2,1	3	N63.03061	E23.83238	127	FIN
	U2157	subsp. *dioica*	LR, SS	0,574	4	0,9	2,1	3	N63.03061	E23.83238	127	FIN
	U2158	subsp. *dioica*	LR, SS	0,566	4	1,0	1,1	1	N63.03061	E23.83238	127	FIN
UP0602	U2160	subsp. *dioica*	LR, SS	0,575	4	1,2	1,4	4	N62.95746	E22.54081	37	FIN
	U2161	subsp. *dioica*	LR, SS	0,575	4	1,2	1,4	4	N62.95746	E22.54081	37	FIN
	U2162	subsp. *dioica*	LR, SS	0,575	4	1,2	1,4	4	N62.95746	E22.54081	37	FIN
	U2163	subsp. *dioica*	LR, SS	0,575	4	1,2	1,4	4	N62.95746	E22.54081	37	FIN
UP0603	U2165	subsp. *dioica*	LR, SS	0,589	4	1,5	1,6	1	N62.97150	E21.49270	4	FIN
	U2166	subsp. *dioica*	LR, SS	0,589	4	1,5	1,6	1	N62.97150	E21.49270	4	FIN

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	U2167	subsp. *dioica*	LR, SS	0,589	4	1,5	1,6	1	N62.97150	E21.49270	4	FIN
UP0604	U2169	subsp. *dioica*	LR, SS	0,572	4	1,1	1,3	5	N62.72737	E21.17329	1	FIN
	U2170	subsp. *dioica*	LR, SS	0,572	4	1,1	1,3	5	N62.72737	E21.17329	1	FIN
	U2171	subsp. *dioica*	LR, SS	0,572	4	1,1	1,3	5	N62.72737	E21.17329	1	FIN
	U2172	subsp. *dioica*	LR, SS	0,572	4	1,1	1,3	5	N62.72737	E21.17329	1	FIN
	U2173	subsp. *dioica*	LR, SS	0,572	4	1,1	1,3	5	N62.72737	E21.17329	1	FIN
UP0605	U2175	subsp. *dioica*	LR, SS	0,582	4	1,3	1,5	3	N62.26381	E21.36276	6	FIN
	U2176	subsp. *dioica*	LR, SS	0,582	4	1,3	1,5	3	N62.26381	E21.36276	6	FIN
	U2177	subsp. *dioica*	LR, SS	0,582	4	1,3	1,5	3	N62.26381	E21.36276	6	FIN
UP0606	U2179	subsp. *dioica*	LR, SS	0,582	4	0,9	1,3	1	N61.56547	E21.68465	1	FIN
	U2180	subsp. *dioica*	LR, SS	0,588	4	0,8	1,3	1	N61.56547	E21.68465	1	FIN
	U2181	subsp. *dioica*	LR, SS	0,574	4	0,7	1,4	1	N61.56547	E21.68465	1	FIN
	U2182	subsp. *dioica* pentaploid	LR, SS	0,715	5	0,8	1,2	1	N61.56547	E21.68465	1	FIN
	U2183	subsp. *dioica*	LR, SS	0,572	4	0,8	1,3	1	N61.56547	E21.68465	1	FIN
UP0607	U2185	subsp. *dioica*	LR, SS	0,575	4	1,5	1,3	1	N61.12825	E21.49078	20	FIN
	U2186	subsp. *dioica*	LR, SS	0,575	4	1,5	1,3	1	N61.12825	E21.49078	20	FIN
	U2187	subsp. *dioica*	LR, SS	0,575	4	1,5	1,3	1	N61.12825	E21.49078	20	FIN
	U2188	subsp. *dioica*	LR, SS	0,575	4	1,5	1,3	1	N61.12825	E21.49078	20	FIN
UP0608	U2189	subsp. *dioica*	LR, SS	0,568	4	0,9	1,3	3	N60.23938	E24.65983	19	FIN
	U2191	subsp. *dioica*	LR, SS	0,568	4	0,9	1,3	3	N60.23938	E24.65983	19	FIN
	U2192	subsp. *dioica*	LR, SS	0,568	4	0,9	1,3	3	N60.23938	E24.65983	19	FIN
UP0609	U2194	subsp. *dioica*	LR, SS	0,569	4	1,2	1,9	3	N59.58903	E25.70749	26	EST
	U2195	subsp. *dioica*	LR, SS	0,569	4	1,2	1,9	3	N59.58903	E25.70749	26	EST
	U2196	subsp. *dioica*	LR, SS	0,569	4	1,2	1,9	3	N59.58903	E25.70749	26	EST
UP0610	U2198	subsp. *dioica*	LR, SS	0,568	4	1,2	1,6	4	N59.56408	E25.86721	19	EST
	U2199	subsp. *dioica*	LR, SS	0,568	4	1,2	1,6	4	N59.56408	E25.86721	19	EST
	U2200	subsp. *dioica*	LR, SS	0,568	4	1,2	1,6	4	N59.56408	E25.86721	19	EST
	U2201	subsp. *dioica*	LR, SS	0,568	4	1,2	1,6	4	N59.56408	E25.86721	19	EST
UP0611	U2202	subsp. *dioica*	LR, SS	0,567	4	0,8	1,4	3	N59.23143	E24.71170	55	EST
	U2203	subsp. *dioica*	LR, SS	0,567	4	0,8	1,4	3	N59.23143	E24.71170	55	EST
	U2204	subsp. *dioica*	LR, SS	0,567	4	0,8	1,4	3	N59.23143	E24.71170	55	EST
UP0612	U2207	subsp. *dioica*	LR, SS	0,580	4	1,8	1,6	3	N59.38068	E27.55390	1	EST
	U2208	subsp. *dioica*	LR, SS	0,580	4	1,8	1,6	3	N59.38068	E27.55390	1	EST
	U2209	subsp. *dioica*	LR, SS	0,580	4	1,8	1,6	3	N59.38068	E27.55390	1	EST
UP0613	U2211	subsp. *dioica*	LR, SS	0,564	4	1,7	1,7	4	N58.98710	E27.16925	40	EST
	U2212	subsp. *dioica*	LR, SS	0,564	4	1,7	1,7	4	N58.98710	E27.16925	40	EST
	U2213	subsp. *dioica*	LR, SS	0,564	4	1,7	1,7	4	N58.98710	E27.16925	40	EST
	U2214	subsp. *dioica*	LR, SS	0,564	4	1,7	1,7	4	N58.98710	E27.16925	40	EST
UP0614	U2215	subsp. *dioica*	LR, SS	0,579	4	1,0	1,3	3	N58.94098	E27.04663	31	EST
	U2216	subsp. *dioica*	LR, SS	0,579	4	1,0	1,3	3	N58.94098	E27.04663	31	EST
	U2217	subsp. *dioica*	LR, SS	0,579	4	1,0	1,3	3	N58.94098	E27.04663	31	EST

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UP0615	U2219	subsp. *dioica*	LR, SS	0,577	4	1,3	1,5	1	N58.01028	E26.13123	118	EST
	U2221	subsp. *dioica*	LR, SS	0,577	4	1,3	1,5	1	N58.01028	E26.13123	118	EST
	U2222	subsp. *dioica*	LR, SS	0,577	4	1,3	1,5	1	N58.01028	E26.13123	118	EST
	U2223	subsp. *dioica*	LR, SS	0,577	4	1,3	1,5	1	N58.01028	E26.13123	118	EST
UP0616	U2225	subsp. *dioica*	LR, SS	0,569	4	1,3	1,5	4	N57.98581	E26.04486	71	EST
	U2226	subsp. *dioica*	LR, SS	0,569	4	1,3	1,5	4	N57.98581	E26.04486	71	EST
	U2227	subsp. *dioica*	LR, SS	0,569	4	1,3	1,5	4	N57.98581	E26.04486	71	EST
	U2228	subsp. *dioica*	LR, SS	0,569	4	1,3	1,5	4	N57.98581	E26.04486	71	EST
UP0617	U2236	subsp. *dioica*	LR, SS	0,563	4	1,1	1,3	2	N56.01236	E23.40613	94	LTU
	U2237	subsp. *dioica*	LR, SS	0,563	4	1,1	1,3	2	N56.01236	E23.40613	94	LTU
UP0618	U2239	subsp. *dioica*	LR, SS	0,566	4	1,3	2,3	3	N55.82765	E23.10500	143	LTU
	U2240	subsp. *dioica*	LR, SS	0,566	4	1,3	2,3	3	N55.82765	E23.10500	143	LTU
	U2241	subsp. *dioica*	LR, SS	0,566	4	1,3	2,3	3	N55.82765	E23.10500	143	LTU
UP0619	U2243	subsp. *dioica*	LR, SS	0,566	4	1,3	1,5	5	N54.80492	E24.26690	53	LTU
	U2244	subsp. *dioica*	LR, SS	0,566	4	1,3	1,5	5	N54.80492	E24.26690	53	LTU
	U2245	subsp. *dioica*	LR, SS	0,566	4	1,3	1,5	5	N54.80492	E24.26690	53	LTU
	U2246	subsp. *dioica*	LR, SS	0,566	4	1,3	1,5	5	N54.80492	E24.26690	53	LTU
	U2247	subsp. *dioica*	LR, SS	0,566	4	1,3	1,5	5	N54.80492	E24.26690	53	LTU
UP0620	U2248	subsp. *dioica*	LR, SS	0,573	4	0,8	1,9	1	N54.64675	E24.93551	156	LTU
	U2250	subsp. *dioica*	LR, SS	0,579	4	1,1	1,2	2	N54.64675	E24.93551	156	LTU
	U2251	subsp. *dioica*	LR, SS	0,579	4	1,1	1,2	2	N54.64675	E24.93551	156	LTU
UP0621	U2264	subsp. *dioica*	PV, TU	0,567	4	0,8	1,1	1	N51.10167	E17.07150	132	POL
	U2265	subsp. *dioica*	PV, TU	0,572	4	0,8	1,2	1	N51.10167	E17.07150	132	POL
	U2266	subsp. *dioica*	PV, TU	0,571	4	0,9	1,2	1	N51.10167	E17.07150	132	POL
UP0622	U2268	subsp. *dioica*	PV, TU	0,580	4	1,6	1,6	5	N51.18257	E16.91867	114	POL
	U2269	subsp. *dioica*	PV, TU	0,580	4	1,6	1,6	5	N51.18257	E16.91867	114	POL
	U2270	subsp. *dioica*	PV, TU	0,580	4	1,6	1,6	5	N51.18257	E16.91867	114	POL
	U2271	subsp. *dioica*	PV, TU	0,580	4	1,6	1,6	5	N51.18257	E16.91867	114	POL
UP0623	U2272	subsp. *dioica*	PV, TU	0,566	4	1,2	1,8	3	N52.02578	E15.57197	50	POL
	U2273	subsp. *dioica*	PV, TU	0,566	4	1,2	1,8	3	N52.02578	E15.57197	50	POL
	U2274	subsp. *dioica*	PV, TU	0,566	4	1,2	1,8	3	N52.02578	E15.57197	50	POL
UP0624	U2275	subsp. *dioica*	PV, TU	0,549	4	1,8	1,5	1	N52.58655	E14.61229	11	POL
	U2276	subsp. *dioica*	PV, TU	0,549	4	1,8	1,5	1	N52.58655	E14.61229	11	POL
	U2277	subsp. *dioica*	PV, TU	0,549	4	1,8	1,5	1	N52.58655	E14.61229	11	POL
UP0625	U2278	subsp. *dioica*	PV, TU	0,559	4	1,2	1,6	3	N52.60095	E14.60101	10	POL
	U2279	subsp. *dioica*	PV, TU	0,559	4	1,2	1,6	3	N52.60095	E14.60101	10	POL
	U2280	subsp. *dioica*	PV, TU	0,559	4	1,2	1,6	3	N52.60095	E14.60101	10	POL
UP0626	U2281	subsp. *dioica*	PV, TU	0,563	4	1,2	1,4	1	N52.48602	E12.83499	29	DEU
	U2282	subsp. *subinermis*	PV, TU	0,299	2	1,7	1,8	1	N52.48602	E12.83499	29	DEU
UP0627	U2284	subsp. *dioica*	PV, TU	0,557	4	0,9	1,4	1	N52.48055	E12.80989	29	DEU
	U2285	subsp. *subinermis*	PV, TU	0,294	2	1,4	2,3	1	N52.48055	E12.80989	29	DEU

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UP0628	U2296	subsp. *subinermis*	ZK	0,297	2	0,9	2,2	1	N48.73739	E16.87706	155	CZE
	U2296	subsp. *subinermis*	ZK	0,301	2	0,7	2,7	1	N48.73739	E16.87706	155	CZE
	U2297	subsp. *subinermis*	ZK	0,296	2	0,9	3,9	1	N48.73739	E16.87706	155	CZE
	U2297	subsp. *subinermis*	ZK	0,300	2	1,1	3,2	1	N48.73739	E16.87706	155	CZE
UP0629	U2305	subsp. *dioica*	FK	0,602	4	1,0	2,1	1	N36.66114	E51.32025	190	IRN
	U2306	subsp. *dioica*	FK	0,624	4	0,9	2,3	1	N36.66114	E51.32025	190	IRN
	U2307	subsp. *dioica*	FK	0,613	4	0,6	2,3	1	N36.66114	E51.32025	190	IRN
UP0630	U2351	subsp. *dioica* aneuploid	LR	0,492	–	1,1	1,5	1	N47.62380	E12.97902	615	DEU
	U2352	subsp. *dioica*	LR	0,565	4	1,3	4,6	1	N47.62380	E12.97902	615	DEU
	U2353	subsp. *dioica*	LR	0,566	4	1,2	1,7	1	N47.62380	E12.97902	615	DEU
	U2354	subsp. *dioica*	LR	0,562	4	1,4	2,0	1	N47.62380	E12.97902	615	DEU
UP0631	U2356	subsp. *dioica*	LR	0,572	4	1,3	1,5	1	N46.68460	E13.67080	607	AUT
	U2357	subsp. *dioica*	LR	0,571	4	1,4	3,7	1	N46.68460	E13.67080	607	AUT
UP0632	U2359	subsp. *pubescens*	LR	0,307	2	1,1	3,9	1	N46.39920	E13.16783	302	ITA
	U2360	subsp. *pubescens*	LR	0,305	2	1,0	3,0	1	N46.39920	E13.16783	302	ITA
	U2361	subsp. *pubescens*	LR	0,307	2	1,0	3,1	1	N46.39920	E13.16783	302	ITA
	U2362	subsp. *pubescens*	LR	0,297	2	1,1	2,1	1	N46.39920	E13.16783	302	ITA
	U2363	subsp. *pubescens*	LR	0,305	2	0,9	3,0	1	N46.39920	E13.16783	302	ITA
UP0633	U2364	subsp. *pubescens*	LR	0,299	2	1,1	3,5	1	N45.52650	E12.26158	12	ITA
	U2365	subsp. *pubescens*	LR	0,302	2	1,1	3,1	1	N45.52650	E12.26158	12	ITA
	U2366	subsp. *pubescens*	LR	0,298	2	1,0	3,5	1	N45.52650	E12.26158	12	ITA
UP0634	U2367	subsp. *pubescens*	LR	0,310	2	1,1	3,3	1	N44.94770	E12.26107	1	ITA
	U2368	subsp. *pubescens*	LR	0,306	2	0,9	3,1	1	N44.94770	E12.26107	1	ITA
	U2369	subsp. *pubescens*	LR	0,304	2	1,4	3,1	1	N44.94770	E12.26107	1	ITA
	U2370	subsp. *pubescens*	LR	0,309	2	1,5	3,6	1	N44.94770	E12.26107	1	ITA
	U2371	subsp. *dioica*	LR	0,611	4	1,2	1,3	1	N44.94770	E12.26107	1	ITA
UP0635	U2372	subsp. *pubescens*	LR	0,297	2	0,9	2,1	1	N44.95785	E12.33095	1	ITA
	U2373	subsp. *pubescens*	LR	0,300	2	1,1	1,9	1	N44.95785	E12.33095	1	ITA
	U2374	subsp. *pubescens*	LR	0,297	2	1,1	1,9	1	N44.95785	E12.33095	1	ITA
	U2375	subsp. *pubescens*	LR	0,300	2	1,1	2,2	1	N44.95785	E12.33095	1	ITA
UP0636	U2376	subsp. *pubescens*	LR	0,303	2	1,0	3,6	1	N45.50597	E11.93240	24	ITA
	U2377	subsp. *pubescens*	LR	0,306	2	1,2	3,8	1	N45.50597	E11.93240	24	ITA
	U2378	subsp. *pubescens*	LR	0,299	2	1,4	1,2	1	N45.50597	E11.93240	24	ITA
	U2379	subsp. *pubescens*	LR	0,303	2	1,1	2,1	1	N45.50597	E11.93240	24	ITA
	U2380	subsp. *pubescens*	LR	0,302	2	1,3	2,2	1	N45.50597	E11.93240	24	ITA
UP0637	U2381	subsp. *pubescens*	LR	0,302	2	1,0	2,3	1	N45.77563	E11.72663	114	ITA
	U2382	subsp. *pubescens*	LR	0,297	2	1,3	2,3	1	N45.77563	E11.72663	114	ITA
	U2383	subsp. *pubescens*	LR	0,304	2	1,2	2,8	1	N45.77563	E11.72663	114	ITA
UP0638	U2384	subsp. *pubescens*	LR	0,298	2	1,2	4,9	1	N45.99642	E11.66612	224	ITA
	U2385	subsp. *pubescens*	LR	0,304	2	1,1	2,1	1	N45.99642	E11.66612	224	ITA
	U2386	subsp. *pubescens*	LR	0,299	2	1,1	2,2	1	N45.99642	E11.66612	224	ITA

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	U2387	subsp. *pubescens*	LR	0,298	2	0,8	1,8	1	N45.99642	E11.66612	224	ITA
	U2388	subsp. *pubescens*	LR	0,299	2	1,4	2,3	1	N45.99642	E11.66612	224	ITA
UP0639	U2389	subsp. *pubescens*	LR	0,311	2	1,5	3,3	1	N46.00285	E11.29060	451	ITA
	U2391	subsp. *pubescens*	LR	0,320	2	1,2	4,7	1	N46.00285	E11.29060	451	ITA
	U2392	subsp. *pubescens*	LR	0,303	2	1,3	3,7	1	N46.00285	E11.29060	451	ITA
	U2393	subsp. *pubescens*	LR	0,301	2	1,0	2,0	1	N46.00285	E11.29060	451	ITA
UP0640	U2395	subsp. *pubescens*	LR	0,317	2	1,1	4,8	1	N45.90287	E11.02720	184	ITA
	U2396	subsp. *pubescens*	LR	0,299	2	1,1	4,3	1	N45.90287	E11.02720	184	ITA
	U2397	subsp. *pubescens*	LR	0,300	2	0,8	2,2	1	N45.90287	E11.02720	184	ITA
	U2398	subsp. *pubescens*	LR	0,300	2	1,3	5,0	1	N45.90287	E11.02720	184	ITA
UP0641	U2399	subsp. *pubescens*	LR	0,302	2	1,1	2,5	1	N45.58527	E10.45353	174	ITA
	U2401	subsp. *pubescens*	LR	0,301	2	1,1	2,2	1	N45.58527	E10.45353	174	ITA
UP0642	U2402	subsp. *pubescens*	LR	0,310	2	1,1	3,4	1	N45.60553	E10.19905	213	ITA
	U2403	subsp. *pubescens*	LR	0,307	2	1,2	3,1	1	N45.60553	E10.19905	213	ITA
	U2404	subsp. *pubescens*	LR	0,313	2	1,3	4,0	1	N45.60553	E10.19905	213	ITA
	U2405	subsp. *pubescens*	LR	0,301	2	1,1	2,4	1	N45.60553	E10.19905	213	ITA
	U2406	subsp. *pubescens*	LR	0,311	2	1,1	3,4	1	N45.60553	E10.19905	213	ITA
UP0643	U2407	subsp. *pubescens*	LR	0,304	2	1,7	2,3	1	N45.69125	E10.11113	332	ITA
	U2408	subsp. *pubescens*	LR	0,303	2	1,0	1,4	1	N45.69125	E10.11113	332	ITA
UP0644	U2409	subsp. *pubescens*	LR	0,316	2	1,5	2,2	1	N45.75367	E10.11938	616	ITA
	U2410	subsp. *pubescens*	LR	0,324	2	0,8	4,0	1	N45.75367	E10.11938	616	ITA
	U2411	subsp. *pubescens*	LR	0,313	2	1,0	3,8	1	N45.75367	E10.11938	616	ITA
	U2412	subsp. *pubescens*	LR	0,295	2	1,0	1,2	1	N45.75367	E10.11938	616	ITA
UP0645	U2413	subsp. *pubescens*	LR	0,298	2	1,4	2,5	1	N45.92070	E10.23918	292	ITA
	U2414	subsp. *pubescens*	LR	0,302	2	1,1	1,8	1	N45.92070	E10.23918	292	ITA
	U2415	subsp. *pubescens*	LR	0,298	2	1,6	2,7	1	N45.92070	E10.23918	292	ITA
UP0646	U2416	subsp. *pubescens*	LR	0,299	2	0,9	1,8	1	N46.10165	E10.31545	556	ITA
	U2417	subsp. *pubescens*	LR	0,300	2	0,9	2,5	1	N46.10165	E10.31545	556	ITA
	U2418	subsp. *pubescens*	LR	0,325	2	1,2	4,8	1	N46.10165	E10.31545	556	ITA
	U2419	subsp. *pubescens*	LR	0,299	2	1,2	1,8	1	N46.10165	E10.31545	556	ITA
UP0647	U2420	subsp. *dioica*	LR	0,601	4	1,3	3,4	1	N46.24527	E10.44912	1225	ITA
	U2421	subsp. *dioica*	LR	0,572	4	1,3	1,3	1	N46.24527	E10.44912	1225	ITA
	U2422	subsp. *dioica*	LR	0,571	4	1,1	1,7	1	N46.24527	E10.44912	1225	ITA
	U2423	subsp. *dioica*	LR	0,619	4	1,3	2,3	1	N46.24527	E10.44912	1225	ITA
	U2424	subsp. *dioica*	LR	0,604	4	0,9	2,6	1	N46.24527	E10.44912	1225	ITA
UP0648	U2425	subsp. *dioica*	LR	0,580	4	1,1	1,5	1	N46.25853	E10.52680	1608	ITA
	U2426	subsp. *dioica*	LR	0,594	4	1,6	3,3	1	N46.25853	E10.52680	1608	ITA
	U2427	subsp. *dioica*	LR	0,601	4	1,1	2,8	1	N46.25853	E10.52680	1608	ITA
	U2428	subsp. *dioica*	LR	0,594	4	1,3	3,5	1	N46.25853	E10.52680	1608	ITA
UP0649	U2429	subsp. *dioica*	LR	0,568	4	1,0	1,4	1	N46.31120	E10.77390	951	ITA
	U2430	subsp. *dioica*	LR	0,584	4	1,1	1,4	1	N46.31120	E10.77390	951	ITA

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	U2431	subsp. *dioica*	LR	0,587	4	1,2	1,4	1	N46.31120	E10.77390	951	ITA
UP0650	U2435	subsp. *dioica*	LR	0,585	4	1,1	2,8	1	N46.48940	E11.03627	1404	ITA
UP0651	U2436	subsp. *pubescens*	LR	0,299	2	1,0	1,2	1	N46.70330	E11.18230	505	ITA
	U2437	subsp. *pubescens*	LR	0,323	2	0,9	3,2	1	N46.70330	E11.18230	505	ITA
	U2438	subsp. *pubescens*	LR	0,317	2	1,3	4,9	1	N46.70330	E11.18230	505	ITA
UP0652	U2439	subsp. *dioica*	LR	0,569	4	1,5	1,6	1	N46.61300	E10.58228	935	ITA
	U2440	subsp. *dioica*	LR	0,588	4	1,2	2,5	1	N46.61300	E10.58228	935	ITA
	U2441	subsp. *pubescens*	LR	0,300	2	0,9	2,2	1	N46.61300	E10.58228	935	ITA
	U2442	subsp. *dioica*	LR	0,626	4	1,2	2,4	1	N46.61300	E10.58228	935	ITA
	U2443	subsp. *pubescens*	LR	0,308	2	0,7	1,9	1	N46.61300	E10.58228	935	ITA
UP0653	U2445	subsp. *dioica*	LR	0,560	4	1,4	1,4	1	N46.47508	E10.36713	1275	ITA
	U2446	subsp. *dioica*	LR	0,564	4	1,1	1,6	1	N46.47508	E10.36713	1275	ITA
	U2447	subsp. *dioica*	LR	0,578	4	1,0	1,2	1	N46.47508	E10.36713	1275	ITA
	U2448	subsp. *dioica*	LR	0,580	4	1,4	2,0	1	N46.47508	E10.36713	1275	ITA
	U2449	subsp. *dioica*	LR	0,570	4	1,2	1,5	1	N46.47508	E10.36713	1275	ITA
UP0654	U2450	subsp. *pubescens*	LR	0,311	2	0,8	2,2	1	N46.23650	E10.22507	530	ITA
	U2451	subsp. *pubescens*	LR	0,308	2	1,9	1,9	1	N46.23650	E10.22507	530	ITA
	U2452	subsp. *pubescens*	LR	0,304	2	0,9	2,0	1	N46.23650	E10.22507	530	ITA
UP0655	U2453	subsp. *pubescens*	LR	0,304	2	1,4	2,5	1	N46.16257	E9.78898	269	ITA
	U2454	subsp. *pubescens*	LR	0,311	2	1,2	2,8	1	N46.16257	E9.78898	269	ITA
	U2455	subsp. *pubescens*	LR	0,304	2	0,8	1,9	1	N46.16257	E9.78898	269	ITA
	U2456	subsp. *pubescens*	LR	0,296	2	0,8	2,6	1	N46.16257	E9.78898	269	ITA
UP0656	U2457	subsp. *pubescens*	LR	0,301	2	1,2	2,3	1	N45.86217	E9.42163	444	ITA
	U2459	subsp. *pubescens*	LR	0,303	2	1,9	2,3	1	N45.86217	E9.42163	444	ITA
	U2460	subsp. *pubescens*	LR	0,297	2	1,0	4,2	1	N45.86217	E9.42163	444	ITA
	U2461	subsp. *pubescens*	LR	0,306	2	0,8	2,8	1	N45.86217	E9.42163	444	ITA
UP0657	U2462	subsp. *pubescens*	LR	0,304	2	0,9	2,1	1	N45.80548	E9.25597	265	ITA
	U2463	subsp. *pubescens*	LR	0,321	2	1,1	3,8	1	N45.80548	E9.25597	265	ITA
	U2464	subsp. *pubescens*	LR	0,308	2	1,2	2,7	1	N45.80548	E9.25597	265	ITA
	U2465	subsp. *pubescens*	LR	0,299	2	1,0	2,1	1	N45.80548	E9.25597	265	ITA
	U2467	subsp. *pubescens*	LR	0,294	2	0,9	2,2	1	N45.80548	E9.25597	265	ITA
UP0658	U2468	subsp. *pubescens*	LR	0,306	2	0,8	3,4	1	N45.78667	E8.92007	411	ITA
	U2469	subsp. *dioica*	LR	0,609	4	0,8	1,4	1	N45.78667	E8.92007	411	ITA
	U2470	subsp. *pubescens*	LR	0,299	2	0,9	1,7	1	N45.78667	E8.92007	411	ITA
	U2471	subsp. *dioica*	LR	0,601	4	1,1	1,8	1	N45.78667	E8.92007	411	ITA
UP0659	U2472	subsp. *pubescens*	LR	0,309	2	1,0	2,4	1	N45.87413	E8.64148	239	ITA
	U2473	subsp. *pubescens*	LR	0,304	2	0,9	2,0	1	N45.87413	E8.64148	239	ITA
	U2474	subsp. *pubescens*	LR	0,307	2	1,6	1,9	1	N45.87413	E8.64148	239	ITA
	U2475	subsp. *pubescens*	LR	0,310	2	0,8	2,5	1	N45.87413	E8.64148	239	ITA
UP0660	U2476	subsp. *pubescens*	LR	0,302	2	0,8	1,8	1	N45.87413	E8.62487	197	ITA
	U2477	subsp. *pubescens*	LR	0,301	2	0,8	1,7	1	N45.87413	E8.62487	197	ITA

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	U2478	subsp. *pubescens*	LR	0,299	2	0,8	1,7	1	N45.87413	E8.62487	197	ITA
	U2479	subsp. *pubescens*	LR	0,304	2	1,1	2,4	1	N45.87413	E8.62487	197	ITA
	U2480	subsp. *pubescens*	LR	0,304	2	1,2	2,8	1	N45.87413	E8.62487	197	ITA
UP0661	U2481	subsp. *pubescens*	LR	0,300	2	1,9	2,0	1	N45.44000	E8.29033	168	ITA
	U2482	subsp. *pubescens*	LR	0,301	2	1,7	2,1	1	N45.44000	E8.29033	168	ITA
	U2483	subsp. *pubescens*	LR	0,304	2	0,9	2,9	1	N45.44000	E8.29033	168	ITA
	U2484	subsp. *pubescens*	LR	0,300	2	1,0	2,1	1	N45.44000	E8.29033	168	ITA
UP0662	U2485	subsp. *dioica*	LR	0,565	4	1,1	1,4	1	N45.56478	E7.81420	282	ITA
	U2486	subsp. *dioica*	LR	0,567	4	1,0	1,6	1	N45.56478	E7.81420	282	ITA
	U2487	subsp. *dioica*	LR	0,568	4	1,1	1,5	1	N45.56478	E7.81420	282	ITA
UP0663	U2488	subsp. *dioica*	LR	0,574	4	0,9	1,1	1	N45.90240	E6.85825	1187	FRA
	U2489	subsp. *dioica*	LR	0,578	4	0,9	1,4	1	N45.90240	E6.85825	1187	FRA
	U2490	subsp. *dioica*	LR	0,577	4	1,0	2,2	1	N45.90240	E6.85825	1187	FRA
	U2491	subsp. *dioica*	LR	0,576	4	0,9	1,4	1	N45.90240	E6.85825	1187	FRA
UP0664	U2492	subsp. *dioica*	LR	0,578	4	0,8	1,4	1	N45.81215	E6.96012	1266	ITA
	U2494	subsp. *dioica*	LR	0,579	4	1,6	1,3	1	N45.81215	E6.96012	1266	ITA
	U2495	subsp. *dioica*	LR	0,582	4	0,9	1,4	1	N45.81215	E6.96012	1266	ITA
UP0665	U2496	subsp. *pubescens*	LR	0,303	2	1,7	2,0	1	N45.70443	E7.67285	349	ITA
	U2497	subsp. *pubescens*	LR	0,310	2	0,9	1,7	1	N45.70443	E7.67285	349	ITA
	U2498	subsp. *pubescens*	LR	0,313	2	1,2	3,0	1	N45.70443	E7.67285	349	ITA
	U2499	subsp. *pubescens*	LR	0,309	2	0,9	2,3	1	N45.70443	E7.67285	349	ITA
UP0666	U2500	subsp. *pubescens*	LR	0,301	2	1,0	1,8	1	N45.21292	E7.78245	194	ITA
	U2501	subsp. *pubescens*	LR	0,299	2	0,9	1,8	1	N45.21292	E7.78245	194	ITA
	U2502	subsp. *pubescens*	LR	0,303	2	1,4	1,6	1	N45.21292	E7.78245	194	ITA
	U2503	subsp. *pubescens*	LR	0,303	2	1,3	2,5	1	N45.21292	E7.78245	194	ITA
	U2504	subsp. *pubescens*	LR	0,302	2	1,2	2,7	1	N45.21292	E7.78245	194	ITA
UP0667	U2505	subsp. *pubescens*	LR	0,305	2	1,1	2,4	1	N44.90648	E7.69230	223	ITA
	U2506	subsp. *pubescens*	LR	0,302	2	1,0	2,5	1	N44.90648	E7.69230	223	ITA
	U2507	subsp. *pubescens*	LR	0,300	2	0,7	2,8	1	N44.90648	E7.69230	223	ITA
	U2508	subsp. *pubescens*	LR	0,302	2	1,2	1,8	1	N44.90648	E7.69230	223	ITA
	U2509	subsp. *pubescens*	LR	0,303	2	1,1	2,9	1	N44.90648	E7.69230	223	ITA
UP0668	U2510	subsp. *pubescens*	LR	0,306	2	1,3	3,5	1	N44.47222	E7.89325	275	ITA
	U2511	subsp. *pubescens*	LR	0,305	2	1,1	2,8	1	N44.47222	E7.89325	275	ITA
	U2512	subsp. *pubescens*	LR	0,301	2	1,0	2,1	1	N44.47222	E7.89325	275	ITA
	U2513	subsp. *pubescens*	LR	0,307	2	0,8	2,8	1	N44.47222	E7.89325	275	ITA
	U2514	subsp. *pubescens*	LR	0,301	2	1,2	2,1	1	N44.47222	E7.89325	275	ITA
UP0669	U2515	subsp. *pubescens*	LR	0,302	2	1,8	2,4	1	N44.37202	E8.07663	465	ITA
	U2516	subsp. *pubescens*	LR	0,306	2	0,9	2,1	1	N44.37202	E8.07663	465	ITA
	U2517	subsp. *pubescens*	LR	0,309	2	1,1	3,1	1	N44.37202	E8.07663	465	ITA
	U2518	subsp. *pubescens*	LR	0,307	2	1,5	2,4	1	N44.37202	E8.07663	465	ITA
UP0670	U2519	subsp. *pubescens*	LR	0,304	2	1,1	2,6	1	N44.34772	E8.20962	451	ITA

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	U2520	subsp. *pubescens*	LR	0,304	2	1,2	2,3	1	N44.34772	E8.20962	451	ITA
	U2521	subsp. *pubescens*	LR	0,306	2	1,4	2,4	1	N44.34772	E8.20962	451	ITA
	U2522	subsp. *pubescens*	LR	0,307	2	1,2	2,4	1	N44.34772	E8.20962	451	ITA
	U2523	subsp. *pubescens*	LR	0,310	2	1,4	2,9	1	N44.34772	E8.20962	451	ITA
UP0671	U2524	subsp. *pubescens*	LR	0,299	2	0,9	1,9	1	N44.37552	E8.50473	83	ITA
	U2525	subsp. *pubescens*	LR	0,300	2	1,3	2,6	1	N44.37552	E8.50473	83	ITA
	U2526	subsp. *pubescens*	LR	0,300	2	1,2	3,6	1	N44.37552	E8.50473	83	ITA
	U2527	subsp. *pubescens*	LR	0,303	2	1,0	2,9	1	N44.37552	E8.50473	83	ITA
UP0672	U2528	subsp. *pubescens*	LR	0,303	2	1,1	3,3	1	N44.48730	E8.49667	387	ITA
	U2529	subsp. *pubescens*	LR	0,300	2	1,1	2,4	1	N44.48730	E8.49667	387	ITA
	U2530	subsp. *pubescens*	LR	0,300	2	1,6	2,9	1	N44.48730	E8.49667	387	ITA
	U2531	subsp. *pubescens*	LR	0,299	2	1,3	2,7	1	N44.48730	E8.49667	387	ITA
	U2532	subsp. *pubescens*	LR	0,317	2	1,3	3,7	1	N44.48730	E8.49667	387	ITA
UP0673	U2533	subsp. *pubescens*	LR	0,311	2	1,0	2,7	1	N44.73902	E8.51898	122	ITA
	U2534	subsp. *pubescens*	LR	0,303	2	1,3	2,4	1	N44.73902	E8.51898	122	ITA
	U2535	subsp. *pubescens*	LR	0,303	2	1,5	2,2	1	N44.73902	E8.51898	122	ITA
UP0674	U2536	subsp. *dioica*	LR	0,592	4	1,0	1,7	1	N45.04970	E8.62982	86	ITA
	U2537	subsp. *pubescens*	LR	0,304	2	1,4	2,5	1	N45.04970	E8.62982	86	ITA
	U2538	subsp. *pubescens*	LR	0,300	2	1,3	2,6	1	N45.04970	E8.62982	86	ITA
	U2539	subsp. *pubescens*	LR	0,313	2	1,1	3,3	1	N45.04970	E8.62982	86	ITA
UP0675	U2540	subsp. *pubescens*	LR	0,299	2	1,1	2,7	1	N45.24735	E8.75097	101	ITA
	U2541	subsp. *pubescens*	LR	0,301	2	1,1	3,6	1	N45.24735	E8.75097	101	ITA
	U2542	subsp. *pubescens*	LR	0,300	2	1,2	2,1	1	N45.24735	E8.75097	101	ITA
	U2543	subsp. *pubescens*	LR	0,300	2	1,4	2,8	1	N45.24735	E8.75097	101	ITA
UP0676	U2544	subsp. *pubescens*	LR	0,298	2	1,3	2,4	1	N45.16738	E9.07907	65	ITA
	U2545	subsp. *pubescens*	LR	0,303	2	1,2	2,4	1	N45.16738	E9.07907	65	ITA
	U2546	subsp. *pubescens*	LR	0,301	2	1,2	2,2	1	N45.16738	E9.07907	65	ITA
	U2547	subsp. *pubescens*	LR	0,300	2	1,4	2,2	1	N45.16738	E9.07907	65	ITA
UP0677	U2548	subsp. *pubescens*	LR	0,303	2	1,4	2,2	1	N44.96310	E9.60420	106	ITA
	U2549	subsp. *pubescens*	LR	0,304	2	1,2	3,0	1	N44.96310	E9.60420	106	ITA
UP0678	U2550	subsp. *pubescens*	LR	0,312	2	1,1	2,8	1	N44.88212	E9.61557	342	ITA
	U2551	subsp. *pubescens*	LR	0,307	2	1,4	2,8	1	N44.88212	E9.61557	342	ITA
	U2552	subsp. *pubescens*	LR	0,307	2	1,4	2,8	1	N44.88212	E9.61557	342	ITA
	U2553	subsp. *pubescens*	LR	0,303	2	1,0	2,2	1	N44.88212	E9.61557	342	ITA
UP0679	U2554	subsp. *pubescens*	LR	0,302	2	1,2	2,7	1	N44.66752	E9.61743	758	ITA
	U2555	subsp. *pubescens*	LR	0,309	2	1,3	2,5	1	N44.66752	E9.61743	758	ITA
	U2556	subsp. *pubescens*	LR	0,306	2	1,2	2,5	1	N44.66752	E9.61743	758	ITA
	U2557	subsp. *pubescens*	LR	0,307	2	0,9	2,2	1	N44.66752	E9.61743	758	ITA
	U2559	subsp. *pubescens*	LR	0,304	2	1,4	2,8	1	N44.66752	E9.61743	758	ITA
	U2560	subsp. *pubescens*	LR	0,299	2	1,7	3,4	1	N44.66752	E9.61743	758	ITA
	U2561	subsp. *pubescens*	LR	0,303	2	1,0	3,6	1	N44.66752	E9.61743	758	ITA

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	U2562	subsp. *pubescens*	LR	0,304	2	1,5	2,1	1	N44.66752	E9.61743	758	ITA
UP0680	U2563	subsp. *pubescens*	LR	0,306	2	1,4	2,5	1	N44.65102	E9.81080	349	ITA
UP0681	U2564	subsp. *pubescens*	LR	0,300	2	1,5	2,7	1	N44.72987	E10.16108	111	ITA
	U2565	subsp. *pubescens*	LR	0,301	2	1,2	1,2	1	N44.72987	E10.16108	111	ITA
	U2566	subsp. *pubescens*	LR	0,303	2	1,9	2,7	1	N44.72987	E10.16108	111	ITA
	U2567	subsp. *pubescens*	LR	0,301	2	1,3	2,6	1	N44.72987	E10.16108	111	ITA
	U2568	subsp. *pubescens*	LR	0,303	2	1,4	1,8	1	N44.72987	E10.16108	111	ITA
UP0682	U2569	subsp. *pubescens*	LR	0,309	2	1,4	3,0	1	N44.93050	E10.36508	42	ITA
	U2570	subsp. *pubescens*	LR	0,305	2	1,3	2,7	1	N44.93050	E10.36508	42	ITA
	U2571	subsp. *pubescens*	LR	0,308	2	1,1	2,5	1	N44.93050	E10.36508	42	ITA
UP0683	U2572	subsp. *pubescens*	LR	0,307	2	1,3	2,3	1	N44.90670	E10.51723	14	ITA
	U2573	subsp. *pubescens*	LR	0,311	2	0,9	2,5	1	N44.90670	E10.51723	14	ITA
	U2574	subsp. *pubescens*	LR	0,324	2	1,2	3,8	1	N44.90670	E10.51723	14	ITA
	U2575	subsp. *pubescens*	LR	0,317	2	1,3	2,5	1	N44.90670	E10.51723	14	ITA
	U2576	subsp. *pubescens*	LR	0,307	2	1,1	2,6	1	N44.90670	E10.51723	14	ITA
	U2577	subsp. *pubescens*	LR	0,302	2	1,4	2,5	1	N44.90670	E10.51723	14	ITA
UP0684	U2578	subsp. *pubescens*	LR	0,305	2	0,7	2,3	1	N45.06637	E10.84375	10	ITA
	U2579	subsp. *pubescens*	LR	0,299	2	1,2	2,6	1	N45.06637	E10.84375	10	ITA
	U2580	subsp. *pubescens*	LR	0,301	2	1,2	2,8	1	N45.06637	E10.84375	10	ITA
	U2581	subsp. *pubescens*	LR	0,307	2	0,7	2,5	1	N45.06637	E10.84375	10	ITA
UP0685	U2582	subsp. *dioica*	LR	0,577	4	1,0	1,2	1	N45.93151	E6.91746	1916	FRA
	U2583	subsp. *dioica*	LR	0,574	4	1,3	1,4	1	N45.93151	E6.91746	1916	FRA
	U2584	subsp. *dioica*	LR	0,561	4	1,2	1,4	1	N45.93151	E6.91746	1916	FRA
UP0686	U2585	subsp. *dioica*	LR	0,575	4	1,3	3,4	1	N48.22452	E17.21377	106	SVK
	U2586	subsp. *dioica*	LR	0,569	4	1,1	1,8	1	N48.22452	E17.21377	106	SVK
	U2587	subsp. *dioica*	LR	0,565	4	1,3	1,4	1	N48.22452	E17.21377	106	SVK
UP0687	U2588	subsp. *dioica*	LR	0,570	4	1,2	1,8	1	N48.22525	E17.21138	140	SVK
	U2589	subsp. *subinermis*	LR	0,298	2	1,5	1,6	1	N48.22525	E17.21138	140	SVK
	U2590	subsp. *dioica*	LR	0,575	4	1,3	1,5	1	N48.22525	E17.21138	140	SVK
	U2591	subsp. *subinermis*	LR	0,299	2	1,5	2,4	1	N48.22525	E17.21138	140	SVK
UP0688	U2592	subsp. *dioica*	LR	0,567	4	0,9	1,3	1	N48.24330	E17.25355	134	SVK
	U2593	subsp. *dioica*	LR	0,568	4	1,0	1,3	1	N48.24330	E17.25355	134	SVK
	U2594	subsp. *dioica*	LR	0,578	4	0,5	1,7	1	N48.24330	E17.25355	134	SVK
	U2595	subsp. *dioica*	LR	0,572	4	0,9	1,6	1	N48.24330	E17.25355	134	SVK
	U2596	subsp. *dioica*	LR	0,595	4	1,2	4,6	1	N48.24330	E17.25355	134	SVK
	U2597	subsp. *dioica*	LR	0,566	4	1,0	1,4	1	N48.24330	E17.25355	134	SVK
	U2598	subsp. *dioica*	LR	0,559	4	1,4	1,1	1	N48.24330	E17.25355	134	SVK
	U2599	U. *kioviensis*	LR	0,338	2	0,8	2,4	1	N48.24330	E17.25355	134	SVK
	U2600	U. *kioviensis*	LR	0,338	2	1,1	1,7	1	N48.24330	E17.25355	134	SVK
	U2601	U. *kioviensis*	LR	0,338	2	1,1	2,3	1	N48.24330	E17.25355	134	SVK
UP0689	U2602	subsp. *dioica*	LR	0,570	4	1,1	1,6	1	N48.24555	E17.24822	135	SVK

ID number of population	ID number of analysis	Taxon	Collector	Relative fluorescence intensity	DNA-ploidy level	CV of standard	CV of sample	N. of individuals in analysis	Latitude (WGS-84)	Longitude (WGS-84)	Altitude (m a.s.l.)	Country (ISO 3166-1)
	U2603	subsp. *dioica*	LR	0,577	4	0,9	1,6	1	N48.24555	E17.24822	135	SVK
	U2604	subsp. *dioica*	LR	0,567	4	1,2	1,3	1	N48.24555	E17.24822	135	SVK
	U2605	subsp. *dioica*	LR	0,571	4	0,9	1,4	1	N48.24555	E17.24822	135	SVK
	U2606	subsp. *dioica*	LR	0,577	4	0,9	1,5	1	N48.24555	E17.24822	135	SVK
UP0690	U2607	subsp. *dioica*	LR	0,564	4	1,2	1,8	1	N48.03842	E17.19805	134	SVK
	U2608	subsp. *dioica*	LR	0,575	4	0,9	1,5	1	N48.03842	E17.19805	134	SVK
UP0691	U2609	subsp. *dioica*	LR	0,574	4	1,3	1,5	1	N48.03718	E17.19877	140	SVK
	U2610	subsp. *dioica*	LR	0,573	4	1,4	1,4	1	N48.03718	E17.19877	140	SVK
	U2611	subsp. *dioica*	LR	0,573	4	1,0	1,5	1	N48.03718	E17.19877	140	SVK
UP0692	U2612	subsp. *dioica*	LR	0,572	4	0,9	1,4	1	N48.04298	E17.17520	139	SVK
	U2613	subsp. *dioica*	LR	0,568	4	0,8	1,4	1	N48.04298	E17.17520	139	SVK
	U2614	subsp. *dioica*	LR	0,571	4	0,9	1,5	1	N48.04298	E17.17520	139	SVK
UP0693	U2615	subsp. *dioica*	LR	0,561	4	1,0	1,6	1	N48.04942	E17.16158	139	SVK
UP0694	U2616	subsp. *dioica*	LR	0,566	4	0,8	1,2	1	N47.77967	E18.13973	102	SVK
	U2617	subsp. *subinermis*	LR	0,295	2	1,3	2,5	1	N47.77967	E18.13973	102	SVK
	U2618	subsp. *dioica*	LR	0,557	4	1,0	1,5	1	N47.77967	E18.13973	102	SVK
	U2619	subsp. *subinermis*	LR	0,300	2	1,7	1,8	1	N47.77967	E18.13973	102	SVK
	U2620	subsp. *subinermis*	LR	0,294	2	0,9	1,4	1	N47.77967	E18.13973	102	SVK
UP0695	U2621	subsp. *dioica*	LR	0,566	4	0,9	1,6	1	N47.80682	E18.09690	113	SVK
	U2622	subsp. *dioica*	LR	0,575	4	1,4	1,6	1	N47.80682	E18.09690	113	SVK
	U2623	subsp. *dioica*	LR	0,570	4	1,3	1,6	1	N47.80682	E18.09690	113	SVK
	U2624	subsp. *dioica*	LR	0,572	4	1,2	1,5	1	N47.80682	E18.09690	113	SVK
	U2625	subsp. *subinermis*	LR	0,297	2	1,1	2,5	1	N47.80682	E18.09690	113	SVK
UP0696	U2626	subsp. *subinermis*	LR	0,296	2	0,9	2,5	1	N47.79298	E18.12825	110	SVK
	U2627	subsp. *subinermis*	LR	0,296	2	1,3	2,1	1	N47.79298	E18.12825	110	SVK
	U2628	subsp. *subinermis*	LR	0,303	2	1,2	2,2	1	N47.79298	E18.12825	110	SVK
	U2629	subsp. *subinermis*	LR	0,299	2	1,3	2,6	1	N47.79298	E18.12825	110	SVK
UP0697	U2631	subsp. *dioica*	LR	0,584	4	0,8	1,6	1	N47.84493	E17.50455	107	HUN
	U2632	subsp. *dioica*	LR	0,577	4	1,0	1,4	1	N47.84493	E17.50455	107	HUN
	U2633	subsp. *dioica*	LR	0,565	4	1,3	1,3	1	N47.84493	E17.50455	107	HUN
	U2634	subsp. *dioica*	LR	0,571	4	1,1	1,5	1	N47.84493	E17.50455	107	HUN
	U2635	subsp. *dioica*	LR	0,571	4	1,8	1,5	1	N47.84493	E17.50455	107	HUN
UP0698	U2636	subsp. *dioica*	LR	0,583	4	1,0	1,5	1	N47.96305	E17.34648	140	HUN
	U2637	subsp. *dioica*	LR	0,565	4	1,0	1,2	1	N47.96305	E17.34648	140	HUN
	U2638	subsp. *dioica*	LR	0,565	4	0,9	1,7	1	N47.96305	E17.34648	140	HUN
	U2639	subsp. *dioica*	LR	0,558	4	1,5	1,5	1	N47.96305	E17.34648	140	HUN
	U2640	subsp. *dioica*	LR	0,579	4	1,2	1,5	1	N47.96305	E17.34648	140	HUN
	U2641	subsp. *dioica*	LR	0,580	4	1,6	1,7	1	N47.96305	E17.34648	140	HUN
UP0699	U2642	subsp. *dioica*	LR	0,591	4	0,9	1,5	1	N47.97180	E17.36667	128	SVK
	U2643	subsp. *dioica*	LR	0,581	4	1,5	4,2	1	N47.97180	E17.36667	128	SVK
	U2644	subsp. *dioica*	LR	0,579	4	1,3	1,7	1	N47.97180	E17.36667	128	SVK

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	U2645	subsp. *dioica*	LR	0,579	4	1,1	1,3	1	N47.97180	E17.36667	128	SVK
	U2646	subsp. *dioica*	LR	0,574	4	1,0	1,2	1	N47.97180	E17.36667	128	SVK
UP0700	U2647	subsp. *dioica*	LR	0,569	4	1,0	1,4	1	N47.97500	E17.36198	129	SVK
	U2648	subsp. *dioica*	LR	0,576	4	0,9	1,4	1	N47.97500	E17.36198	129	SVK
	U2649	subsp. *dioica*	LR	0,581	4	0,9	1,3	1	N47.97500	E17.36198	129	SVK
	U2650	subsp. *dioica*	LR	0,579	4	1,4	1,3	1	N47.97500	E17.36198	129	SVK
	U2651	subsp. *dioica*	LR	0,569	4	1,2	1,5	1	N47.97500	E17.36198	129	SVK
UP0701	U2652	subsp. *dioica*	LR	0,571	4	1,7	1,7	1	N47.97800	E17.35777	117	SVK
	U2653	subsp. *dioica*	LR	0,567	4	1,3	4,2	1	N47.97800	E17.35777	117	SVK
	U2654	subsp. *dioica*	LR	0,584	4	1,3	1,8	1	N47.97800	E17.35777	117	SVK
	U2655	subsp. *dioica*	LR	0,575	4	1,1	1,4	1	N47.97800	E17.35777	117	SVK
	U2656	subsp. *dioica*	LR	0,564	4	0,8	1,2	1	N47.97800	E17.35777	117	SVK
	U2657	subsp. *dioica*	LR	0,568	4	1,0	1,6	1	N47.97800	E17.35777	117	SVK
UP0702	U2658	subsp. *dioica*	LR	0,569	4	1,1	1,9	1	N47.90598	E17.45193	125	SVK
	U2659	subsp. *dioica*	LR	0,567	4	0,8	1,3	1	N47.90598	E17.45193	125	SVK
	U2660	subsp. *dioica*	LR	0,568	4	1,5	1,2	1	N47.90598	E17.45193	125	SVK
	U2661	subsp. *dioica*	LR	0,573	4	0,9	1,5	1	N47.90598	E17.45193	125	SVK
	U2662	subsp. *dioica*	LR	0,573	4	1,0	1,3	1	N47.90598	E17.45193	125	SVK
	U2663	subsp. *dioica*	LR	0,566	4	1,7	1,3	1	N47.90598	E17.45193	98	SVK
	U2664	subsp. *dioica*	LR	0,571	4	0,9	1,3	1	N47.90598	E17.45193	98	SVK
UP0703	U2665	subsp. *dioica*	PV, RB, TU	0,577	4	1,5	1,8	1	N37.75986	E46.51035	2910	IRN
	U2666	subsp. *dioica*	PV, RB, TU	0,575	4	1,1	2,4	1	N37.75986	E46.51035	2910	IRN
	U2667	subsp. *dioica*	PV, RB, TU	0,572	4	1,3	3,2	1	N37.75986	E46.51035	2910	IRN
	U2669	subsp. *dioica*	PV, RB, TU	0,567	4	0,9	2,3	1	N37.75986	E46.51035	2910	IRN
	U2670	subsp. *dioica*	PV, RB, TU	0,570	4	1,3	3,0	1	N37.75986	E46.51035	2910	IRN
	U2671	subsp. *dioica*	PV, RB, TU	0,581	4	1,0	3,3	1	N37.75986	E46.51035	2910	IRN
UP0704	U2672	subsp. *dioica*	PV, RB, TU	0,583	4	1,5	3,4	1	N38.10666	E48.13635	1472	IRN
	U2673	subsp. *dioica*	PV, RB, TU	0,569	4	1,3	2,9	1	N38.10666	E48.13635	1472	IRN
	U2674	subsp. *dioica*	PV, RB, TU	0,602	4	1,1	3,6	1	N38.10666	E48.13635	1472	IRN
	U2675	subsp. *dioica*	PV, RB, TU	0,594	4	1,3	3,8	1	N38.10666	E48.13635	1472	IRN
	U2676	subsp. *dioica*	PV, RB, TU	0,592	4	1,0	2,2	1	N38.10666	E48.13635	1472	IRN
UP0705	U2678	subsp. *dioica*	PV, RB, TU	0,583	4	1,2	3,4	1	N38.21084	E47.87413	3090	IRN
	U2679	subsp. *dioica*	PV, RB, TU	0,570	4	1,2	3,3	1	N38.21084	E47.87413	3090	IRN
	U2681	subsp. *dioica*	PV, RB, TU	0,581	4	1,4	2,4	1	N38.21084	E47.87413	3090	IRN
	U2682	subsp. *dioica*	PV, RB, TU	0,574	4	1,6	2,6	1	N38.21084	E47.87413	3090	IRN
UP0706	U2683	subsp. *dioica*	PV, RB, TU	0,589	4	1,2	1,9	1	N38.11178	E47.94624	1952	IRN
UP0707	U2685	subsp. *dioica*	PV, RB, TU	0,595	4	1,1	3,5	1	N38.33353	E47.96654	2662	IRN
	U2687	subsp. *dioica*	PV, RB, TU	0,590	4	1,4	4,0	1	N38.33353	E47.96654	2662	IRN
	U2688	subsp. *dioica*	PV, RB, TU	0,583	4	1,3	3,0	1	N38.33353	E47.96654	2662	IRN
UP0708	U2692	subsp. *dioica*	PV, RB, TU	0,581	4	1,4	3,4	1	N38.32907	E47.96724	2548	IRN
UP0709	U2693	subsp. *dioica*	PV, RB, TU	0,586	4	1,5	3,1	1	N37.56881	E48.60270	1935	IRN

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	U2694	subsp. *dioica*	PV, RB, TU	0,578	4	1,3	3,3	1	N37.56881	E48.60270	1935	IRN
	U2695	subsp. *dioica*	PV, RB, TU	0,581	4	1,1	2,3	1	N37.56881	E48.60270	1935	IRN
	U2696	subsp. *dioica*	PV, RB, TU	0,592	4	1,1	4,3	1	N37.56881	E48.60270	1935	IRN
UP0710	U2697	subsp. *dioica*	PV, RB, TU	0,583	4	1,5	2,9	1	N37.57083	E48.67630	2273	IRN
	U2698	subsp. *dioica*	PV, RB, TU	0,606	4	1,2	3,4	1	N37.57083	E48.67630	2273	IRN
	U2699	subsp. *dioica*	PV, RB, TU	0,576	4	1,6	3,8	1	N37.57083	E48.67630	2273	IRN
	U2700	subsp. *dioica*	PV, RB, TU	0,566	4	1,4	3,5	1	N37.57083	E48.67630	2273	IRN
UP0711	U2701	subsp. *dioica*	PV, RB, TU	0,577	4	1,2	2,3	1	N37.16932	E48.92923	2110	IRN
	U2702	subsp. *dioica*	PV, RB, TU	0,592	4	1,1	4,3	1	N37.16932	E48.92923	2110	IRN
	U2703	subsp. *dioica*	PV, RB, TU	0,600	4	1,1	4,7	1	N37.16932	E48.92923	2110	IRN
	U2704	subsp. *dioica*	PV, RB, TU	0,579	4	1,8	2,8	1	N37.16932	E48.92923	2110	IRN
	U2705	subsp. *dioica*	PV, RB, TU	0,580	4	1,7	2,9	1	N37.16932	E48.92923	2110	IRN
UP0712	U2707	subsp. *dioica*	PV, RB, TU	0,592	4	1,7	3,6	1	N37.17198	E48.97948	1450	IRN
UP0713	U2708	subsp. *dioica*	PV, RB, TU	0,599	4	1,4	4,4	1	N37.19984	E49.21139	125	IRN
UP0714	U2711	subsp. *dioica*	PV, RB, TU	0,575	4	1,3	3,4	1	N36.85701	E50.48173	1726	IRN
	U2712	subsp. *dioica*	PV, RB, TU	0,590	4	1,9	3,5	1	N36.85701	E50.48173	1726	IRN
UP0715	U2713	subsp. *dioica*	PV, RB, TU	0,600	4	1,4	4,1	1	N36.35899	E52.35977	246	IRN
	U2714	subsp. *dioica*	PV, RB, TU	0,604	4	1,6	3,1	1	N36.35899	E52.35977	246	IRN
UP0716	U2717	subsp. *dioica*	PV, RB, TU	0,598	4	1,3	3,5	1	N36.28833	E52.88775	249	IRN
	U2718	subsp. *dioica*	PV, RB, TU	0,601	4	1,7	3,5	1	N36.28833	E52.88775	249	IRN
	U2719	subsp. *dioica*	PV, RB, TU	0,578	4	1,5	3,1	1	N36.28833	E52.88775	249	IRN
UP0717	U2720	subsp. *dioica*	PV, RB, TU	0,584	4	1,0	2,9	1	N36.06619	E53.15799	1502	IRN
	U2721	subsp. *dioica*	PV, RB, TU	0,604	4	1,4	3,3	1	N36.06619	E53.15799	1502	IRN
UP0718	U2723	subsp. *dioica*	PV, RB, TU	0,590	4	1,6	4,3	1	N35.80444	E52.29733	2878	IRN
	U2724	subsp. *dioica*	PV, RB, TU	0,580	4	1,9	4,9	1	N35.80444	E52.29733	2878	IRN
	U2725	subsp. *dioica*	PV, RB, TU	0,574	4	1,3	3,0	1	N35.80444	E52.29733	2878	IRN
	U2726	subsp. *dioica*	PV, RB, TU	0,584	4	1,3	2,9	1	N35.80444	E52.29733	2878	IRN
	U2727	subsp. *dioica*	PV, RB, TU	0,591	4	1,3	3,5	1	N35.80444	E52.29733	2878	IRN
UP0719	U2728	subsp. *dioica*	PV, RB, TU	0,577	4	1,8	2,7	1	N35.80882	E52.28233	2968	IRN
	U2729	subsp. *dioica*	PV, RB, TU	0,588	4	1,2	2,4	1	N35.80882	E52.28233	2968	IRN
	U2730	subsp. *dioica*	PV, RB, TU	0,598	4	1,3	2,6	1	N35.80882	E52.28233	2968	IRN
	U2731	subsp. *dioica*	PV, RB, TU	0,596	4	1,2	3,5	1	N35.80882	E52.28233	2968	IRN
	U2732	subsp. *dioica*	PV, RB, TU	0,624	4	2,2	2,9	1	N35.80882	E52.28233	2968	IRN
	U2733	subsp. *dioica*	PV, RB, TU	0,583	4	1,1	1,9	1	N35.80882	E52.28233	2968	IRN
UP0720	U2734	subsp. *dioica*	PV, RB, TU	0,595	4	1,4	3,7	1	N36.20252	E51.92603	1925	IRN
	U2735	subsp. *dioica*	PV, RB, TU	0,586	4	1,2	4,7	1	N36.20252	E51.92603	1925	IRN
UP0721	U2736	subsp. *dioica*	PV, RB, TU	0,613	4	1,6	4,3	1	N36.23832	E51.43928	3140	IRN
	U2737	subsp. *dioica*	PV, RB, TU	0,593	4	1,4	3,4	1	N36.23832	E51.43928	3140	IRN
	U2738	subsp. *dioica*	PV, RB, TU	0,609	4	1,1	4,6	1	N36.23832	E51.43928	3140	IRN
	U2739	subsp. *dioica*	PV, RB, TU	0,585	4	1,4	2,9	1	N36.23832	E51.43928	3140	IRN
	U2740	subsp. *dioica*	PV, RB, TU	0,570	4	1,5	3,3	1	N36.23832	E51.43928	3140	IRN

ID number of population	ID number of analysis	Taxon	Collector	Relative fluorescence intensity	DNA-ploidy level	CV of standard	CV of sample	N. of individuals in analysis	Latitude (WGS-84)	Longitude (WGS-84)	Altitude (m a.s.l.)	Country (ISO 3166-1)
	U2741	subsp. *dioica*	PV, RB, TU	0,574	4	1,7	2,6	1	N36.23832	E51.43928	3140	IRN
UP0722	U2742	subsp. *dioica*	PV, RB, TU	0,614	4	1,9	3,2	1	N36.17365	E51.31466	2565	IRN
	U2743	subsp. *dioica*	PV, RB, TU	0,578	4	1,1	2,5	1	N36.17365	E51.31466	2565	IRN
	U2744	subsp. *dioica*	PV, RB, TU	0,613	4	1,7	4,0	1	N36.17365	E51.31466	2565	IRN
UP0723	U2745	subsp. *dioica*	PV, RB, TU	0,596	4	1,3	1,3	1	N36.05601	E51.40791	2604	IRN
UP0724	U2748	subsp. *dioica*	RB, TU	0,566	4	1,3	2,0	1	N41.53789	E22.13830	128	MKD
	U2749	subsp. *dioica*	RB, TU	0,571	4	1,1	1,8	1	N41.53789	E22.13830	128	MKD
	U2750	subsp. *dioica*	RB, TU	0,570	4	1,5	1,8	1	N41.53789	E22.13830	128	MKD
UP0725	U2751	subsp. *dioica*	RB, TU	0,598	4	1,2	1,9	1	N41.19679	E22.77564	146	GRC
	U2752	subsp. *dioica*	RB, TU	0,597	4	1,5	1,9	1	N41.19679	E22.77564	146	GRC
	U2753	subsp. *dioica*	RB, TU	0,589	4	0,9	1,6	1	N41.19679	E22.77564	146	GRC
UP0726	U2754	subsp. *dioica*	RB, TU	0,571	4	1,2	1,9	1	N41.44564	E23.27741	86	BGR
	U2767	subsp. *subinermis*	RB, TU	0,297	2	0,9	2,5	1	N41.44564	E23.27741	86	BGR
	U2768	subsp. *subinermis*	RB, TU	0,302	2	0,9	2,8	1	N41.44564	E23.27741	86	BGR
	U2873	subsp. *dioica*	RB, TU	0,585	4	1,1	2,6	1	N41.44564	E23.27741	86	BGR
	U2874	subsp. *subinermis*	RB, TU	0,309	2	0,8	3,4	1	N41.44564	E23.27741	86	BGR
UP0727	U2755	subsp. *dioica*	RB, TU	0,568	4	0,9	1,4	2	N41.52702	E23.40403	454	BGR
	U2756	subsp. *dioica*	RB, TU	0,568	4	0,9	1,4	2	N41.52702	E23.40403	454	BGR
	U2761	subsp. *dioica*	RB, TU	0,577	4	1,2	1,7	1	N41.52702	E23.40403	454	BGR
UP0728	U2757	subsp. *dioica*	RB, TU	0,564	4	1,2	1,5	1	N42.13247	E23.33359	1236	BGR
	U2758	subsp. *dioica*	RB, TU	0,561	4	1,0	1,5	1	N42.13247	E23.33359	1236	BGR
UP0729	U2759	subsp. *dioica*	RB, TU	0,567	4	1,2	1,9	1	N44.69285	E20.58211	116	SRB
	U2766	subsp. *dioica*	RB, TU	0,567	4	1,2	1,9	1	N44.69285	E20.58211	116	SRB
UP0730	U2760	subsp. *dioica*	RB, TU	0,583	4	1,2	1,2	2	N41.40521	E22.26003	133	MKD
	U2762	subsp. *dioica*	RB, TU	0,561	4	1,2	2,2	1	N41.40521	E22.26003	133	MKD
	U2769	subsp. *dioica*	RB, TU	0,583	4	1,2	1,2	2	N41.40521	E22.26003	133	MKD
UP0731	U2763	subsp. *subinermis*	RB, TU	0,297	2	0,9	1,8	1	N42.42413	E21.73910	399	SRB
UP0732	U2764	subsp. *dioica*	RB, TU	0,570	4	1,2	1,8	3	N43.33701	E22.08378	300	SRB
UP0733	U2765	subsp. *dioica*	RB, TU	0,571	4	1,4	1,7	3	N44.69344	E20.01966	72	SRB
UP0734	U2770	subsp. *dioica*	JH, ZK	0,576	4	1,2	1,2	1	N42.79472	E13.07389	551	ITA
	U2771	subsp. *dioica*	JH, ZK	0,594	4	0,9	1,2	1	N42.79472	E13.07389	551	ITA
	U2772	subsp. *dioica*	JH, ZK	0,570	4	0,8	1,2	1	N42.79472	E13.07389	551	ITA
	U2773	subsp. *dioica*	JH, ZK	0,571	4	0,8	1,2	1	N42.79472	E13.07389	551	ITA
	U2789	subsp. *dioica*	JH, ZK	0,584	4	0,9	1,2	1	N42.79472	E13.07389	551	ITA
UP0735	U2779	subsp. *pubescens*	JH, ZK	0,321	2	0,6	1,7	1	N39.35428	E9.55250	8	ITA
	U2780	subsp. *pubescens*	JH, ZK	0,319	2	0,8	2,0	1	N39.35428	E9.55250	8	ITA
	U2783	subsp. *pubescens*	JH, ZK	0,319	2	0,8	1,4	1	N39.35428	E9.55250	8	ITA
UP0736	U2790	subsp. *dioica*	JH, ZK	0,588	4	0,7	1,2	1	N41.20500	E13.79417	4	ITA
	U2791	subsp. *dioica*	JH, ZK	0,593	4	0,8	1,6	1	N41.20500	E13.79417	4	ITA
	U2792	subsp. *dioica*	JH, ZK	0,583	4	0,9	1,3	1	N41.20500	E13.79417	4	ITA
	U2793	subsp. *dioica*	JH, ZK	0,590	4	0,9	1,0	1	N41.20500	E13.79417	4	ITA

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	U2794	subsp. *dioica*	JH, ZK	0,601	4	0,8	1,2	1	N41.20500	E13.79417	4	ITA
UP0737	U2798	subsp. *dioica*	CP	0,614	4	0,8	2,9	1	N48.21922	E16.22628	280	AUT
	U2799	subsp. *dioica*	CP	0,614	4	0,8	2,0	1	N48.21922	E16.22628	280	AUT
	U2800	subsp. *dioica*	CP	0,606	4	1,0	2,2	1	N48.21922	E16.22628	280	AUT
UP0738	U2801	subsp. *dioica*	CP	0,594	4	0,8	1,2	1	N48.39322	E15.68928	208	AUT
	U2802	subsp. *dioica*	CP	0,610	4	0,8	2,3	1	N48.39322	E15.68928	208	AUT
	U2803	subsp. *dioica*	CP	0,593	4	1,1	1,9	1	N48.39322	E15.68928	208	AUT
	U2804	subsp. *dioica*	CP	0,585	4	1,0	1,6	1	N48.39322	E15.68928	208	AUT
	U2805	subsp. *dioica*	CP	0,598	4	1,0	1,4	1	N48.39322	E15.68928	208	AUT
	U2806	subsp. *dioica*	CP	0,588	4	0,8	2,0	1	N48.39322	E15.68928	208	AUT
	U2807	subsp. *dioica*	CP	0,586	4	1,8	2,1	1	N48.39322	E15.68928	208	AUT
UP0739	U2808	subsp. *dioica*	CP	0,597	4	1,2	3,7	1	N48.38997	E15.69161	199	AUT
	U2809	subsp. *dioica*	CP	0,579	4	1,1	2,2	1	N48.38997	E15.69161	199	AUT
	U2810	subsp. *dioica*	CP	0,568	4	0,9	1,7	1	N48.38997	E15.69161	199	AUT
	U2812	subsp. *dioica*	CP	0,585	4	0,9	1,9	1	N48.38997	E15.69161	199	AUT
	U2813	subsp. *dioica*	CP	0,579	4	1,1	2,6	1	N48.38997	E15.69161	199	AUT
	U2814	subsp. *dioica*	CP	0,580	4	0,9	2,5	1	N48.38997	E15.69161	199	AUT
	U2816	subsp. *dioica*	CP	0,565	4	0,9	1,9	1	N48.38997	E15.69161	199	AUT
	U2817	subsp. *dioica*	CP	0,588	4	0,9	2,7	1	N48.38997	E15.69161	199	AUT
	U2818	subsp. *dioica*	CP	0,588	4	0,7	2,0	1	N48.38997	E15.69161	199	AUT
UP0740	U2819	subsp. *dioica*	FK	0,559	4	0,7	1,4	1	N48.38924	E15.68373	200	AUT
UP0741	U2820	subsp. *dioica*	JP	0,574	4	1,2	1,4	1	N52.09506	W2.33837	313	GBR
UP0742	U2821	subsp. *dioica*	JP	0,573	4	1,1	1,5	1	N52.11168	W2.34012	313	GBR
UP0743	U2822	subsp. *dioica*	JP	0,564	4	0,9	1,4	1	N52.11189	W2.33459	313	GBR
UP0744	U2824	subsp. *dioica*	OK	0,579	4	1,0	1,4	1	N45.52917	E25.37028	725	ROU
UP0745	U2825	subsp. *dioica*	OK	0,564	4	1,4	1,4	1	N45.17806	E23.78583	522	ROU
	U2826	subsp. *dioica*	OK	0,561	4	1,8	1,4	1	N45.17806	E23.78583	522	ROU
UP0746	U2827	subsp. *dioica*	GF	0,581	4	1,3	1,9	5	N52.62146	E1.23149	10	GBR
UP0747	U2830	subsp. *dioica*	RB, TU	0,586	4	1,0	1,8	1	N47.64449	E17.59997	116	HUN
UP0748	U2832	subsp. *dioica*	RB, TU	0,587	4	1,1	1,7	1	N45.85720	E18.43004	171	HUN
	U2833	subsp. *dioica*	RB, TU	0,559	4	1,2	1,9	1	N45.85720	E18.43004	171	HUN
UP0749	U2834	subsp. *dioica*	RB, TU	0,568	4	1,2	1,8	2	N46.21278	E18.19086	229	HUN
UP0750	U2835	subsp. *dioica*	RB, TU	0,585	4	1,3	1,7	4	N46.35242	E17.69505	148	HUN
UP0751	U2836	subsp. *subinermis*	RB, TU	0,303	2	1,1	2,4	1	N46.70164	E17.25790	110	HUN
	U2837	subsp. *subinermis*	RB, TU	0,306	2	1,1	3,0	1	N46.70164	E17.25790	110	HUN
	U2838	subsp. *dioica*	RB, TU	0,587	4	1,0	2,0	1	N46.70164	E17.25790	110	HUN
	U2839	subsp. *dioica*	RB, TU	0,573	4	1,1	1,4	1	N46.70164	E17.25790	110	HUN
	U2840	subsp. *dioica*	RB, TU	0,581	4	1,2	1,8	1	N46.70164	E17.25790	110	HUN
UP0752	U2841	subsp. *dioica*	RB, TU	0,571	4	1,1	1,5	2	N46.68832	E16.72637	197	HUN
UP0753	U2842	subsp. *dioica*	RB, TU	0,575	4	0,9	1,6	1	N46.73830	E16.63762	230	HUN
UP0754	U2843	subsp. *dioica*	RB, TU	0,566	4	1,1	1,8	1	N47.00717	E16.61203	191	HUN

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	U2844	subsp. *dioica*	RB, TU	0,577	4	1,1	1,9	1	N47.00717	E16.61203	191	HUN
	U2845	subsp. *dioica*	RB, TU	0,574	4	1,1	1,4	1	N47.00717	E16.61203	191	HUN
	U2846	subsp. *dioica*	RB, TU	0,578	4	1,0	1,7	1	N47.00717	E16.61203	191	HUN
UP0755	U2847	subsp. *dioica*	RB, TU	0,567	4	1,1	1,8	2	N47.23156	E17.11906	214	HUN
UP0756	U2848	subsp. *subinermis*	RB, TU	0,306	2	1,3	3,2	1	N47.73218	E18.31424	114	HUN
	U2849	subsp. *dioica*	RB, TU	0,581	4	1,3	1,7	1	N47.73218	E18.31424	114	HUN
UP0757	U2850	subsp. *dioica*	RB, TU	0,584	4	1,0	1,3	1	N47.76276	E18.69994	105	HUN
UP0758	U2851	subsp. *dioica*	RB, TU	0,564	4	1,0	1,4	2	N47.66878	E18.95017	221	HUN
UP0759	U2852	subsp. *dioica*	RB, TU	0,576	4	1,2	1,7	5	N47.40110	E19.02083	114	HUN
UP0760	U2853	subsp. *dioica*	RB, TU	0,569	4	1,0	2,0	2	N47.10633	E19.36230	113	HUN
UP0761	U2854	subsp. *dioica*	RB, TU	0,573	4	1,2	1,7	1	N46.81113	E18.93695	98	HUN
	U2855	subsp. *dioica*	RB, TU	0,579	4	1,3	1,7	1	N46.81113	E18.93695	98	HUN
	U2856	subsp. *dioica*	RB, TU	0,574	4	1,3	1,3	1	N46.81113	E18.93695	98	HUN
	U2857	subsp. *dioica*	RB, TU	0,569	4	1,3	1,9	1	N46.81113	E18.93695	98	HUN
	U2858	subsp. *dioica*	RB, TU	0,565	4	1,0	1,9	1	N46.81113	E18.93695	98	HUN
	U2859	subsp. *dioica*	RB, TU	0,569	4	1,4	2,0	1	N46.81113	E18.93695	98	HUN
	U2860	subsp. *dioica*	RB, TU	0,585	4	1,0	1,7	1	N46.81113	E18.93695	98	HUN
	U2861	subsp. *dioica*	RB, TU	0,594	4	1,3	1,3	1	N46.81113	E18.93695	98	HUN
	U2862	subsp. *dioica* pentaploid	RB, TU	0,726	5	1,0	1,1	1	N46.81113	E18.93695	98	HUN
UP0762	U2863	subsp. *dioica*	RB, TU	0,578	4	1,3	1,9	2	N46.41502	E18.79731	88	HUN
UP0763	U2864	subsp. *dioica*	RB, TU	0,569	4	1,2	1,5	1	N46.17097	E18.32557	408	HUN
	U2865	subsp. *dioica*	RB, TU	0,580	4	1,2	1,9	1	N46.17097	E18.32557	408	HUN
UP0764	U2866	subsp. *subinermis*	RB, TU	0,304	2	1,3	3,0	1	N48.17976	E16.97722	152	AUT
	U2867	subsp. *subinermis*	RB, TU	0,301	2	1,2	3,1	1	N48.17976	E16.97722	152	AUT
	U2868	subsp. *dioica*	RB, TU	0,575	4	1,4	2,1	1	N48.17976	E16.97722	152	AUT
	U2869	subsp. *subinermis*	RB, TU	0,302	2	1,3	2,7	1	N48.17976	E16.97722	152	AUT
UP0765	U2871	subsp. *dioica*	GF	0,585	4	0,6	1,6	4	N54.37762	E19.42514	10	POL
UP0766	U2872	subsp. *dioica*	GF	0,571	4	0,8	1,5	1	N51.67240	E15.71750	114	POL
UP0767	U2877	subsp. *dioica*	LR	0,565	4	1,2	1,7	1	N52.37696	E4.88763	13	NLD
	U2878	subsp. *dioica*	LR	0,565	4	1,2	1,7	1	N52.37696	E4.88763	13	NLD
UP0768	U2879	subsp. *dioica*	LR	0,568	4	0,9	1,4	1	N52.37532	E4.91007	1	NLD
	U2880	subsp. *dioica*	LR	0,568	4	0,9	1,4	1	N52.37532	E4.91007	1	NLD
	U2881	subsp. *dioica*	LR	0,568	4	0,9	1,4	1	N52.37532	E4.91007	1	NLD
UP0769	U2882	subsp. *dioica*	LR	0,569	4	1,0	1,4	1	N52.11840	E4.29253	23	NLD
	U2883	subsp. *dioica*	LR	0,569	4	1,0	1,4	1	N52.11840	E4.29253	23	NLD
	U2884	subsp. *dioica*	LR	0,569	4	1,0	1,4	1	N52.11840	E4.29253	23	NLD
UP0770	U2885	subsp. *dioica* pentaploid	GF	0,711	5	0,7	0,8	1	N50.59951	E14.03729	224	CZE
	U3185	subsp. *dioica*	GF	0,563	4	0,7	1,1	1	N50.59951	E14.03729	224	CZE
UP0771	U2905	subsp. *dioica*	FK	0,580	4	0,7	2,3	1	N41.66000	E43.65279	2000	GEO
UP0772	U2917	subsp. *subinermis*	TU	0,301	2	0,5	1,6	1	N42.80928	E9.48922	7	FRA
	U2918	subsp. *subinermis*	TU	0,313	2	1,3	3,9	1	N42.80928	E9.48922	7	FRA

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UP0773	U2919	subsp. *subinermis*	TU	0,296	2	0,8	1,5	1	N42.48634	E9.28053	150	FRA
UP0774	U2920	U. *atrovirens*	TU	0,306	2	0,8	2,7	1	N42.30477	E9.15027	460	FRA
	U2921	U. *atrovirens*	TU	0,310	2	0,8	1,7	1	N42.30477	E9.15027	460	FRA
UP0775	U2922	subsp. *subinermis*	TU	0,316	2	1,0	3,3	1	N42.30138	E9.15204	410	FRA
	U2923	subsp. *subinermis*	TU	0,320	2	1,2	3,2	1	N42.30138	E9.15204	410	FRA
UP0776	U2924	U. *atrovirens*	TU	0,311	2	0,8	2,8	1	N42.37303	E9.14494	440	FRA
	U2925	U. *atrovirens*	TU	0,311	2	0,8	1,7	1	N42.37303	E9.14494	440	FRA
UP0777	U2927	U. *atrovirens*	TU	0,311	2	0,7	2,3	1	N42.24014	E8.84380	790	FRA
	U2928	U. *atrovirens*	TU	0,316	2	0,7	1,5	1	N42.24014	E8.84380	790	FRA
UP0778	U2930	subsp. *subinermis*	LR	0,309	2	1,2	3,0	1	N48.77615	E12.93960	331	DEU
	U2931	subsp. *subinermis*	LR	0,297	2	0,8	1,9	1	N48.77615	E12.93960	331	DEU
	U2932	subsp. *dioica*	LR	0,593	4	1,4	2,0	1	N48.77615	E12.93960	331	DEU
	U2933	subsp. *subinermis*	LR	0,306	2	1,4	2,5	1	N48.77615	E12.93960	331	DEU
	U2934	subsp. *subinermis*	LR	0,301	2	1,0	2,4	1	N48.77615	E12.93960	331	DEU
	U2935	subsp. *subinermis*	LR	0,290	2	1,2	4,4	1	N48.77615	E12.93960	331	DEU
	U2936	subsp. *subinermis*	LR	0,302	2	0,9	3,1	1	N48.77615	E12.93960	331	DEU
	U2937	subsp. *subinermis*	LR	0,297	2	1,4	2,9	1	N48.77615	E12.93960	331	DEU
	U2938	subsp. *subinermis*	LR	0,309	2	1,2	2,8	1	N48.77615	E12.93960	331	DEU
UP0779	U2939	subsp. *dioica*	LR	0,571	4	1,1	1,4	1	N48.98442	E12.44242	331	DEU
	U2940	subsp. *subinermis*	LR	0,300	2	1,4	2,8	1	N48.98442	E12.44242	331	DEU
	U2941	subsp. *dioica*	LR	0,567	4	0,8	1,1	1	N48.98442	E12.44242	331	DEU
	U2942	subsp. *dioica*	LR	0,580	4	0,8	1,6	1	N48.98442	E12.44242	331	DEU
	U2943	subsp. *dioica*	LR	0,579	4	1,0	1,1	1	N48.98442	E12.44242	331	DEU
UP0780	U2944	subsp. *dioica*	LR	0,581	4	1,2	1,6	1	N49.05863	E11.95813	335	DEU
	U2945	subsp. *dioica*	LR	0,569	4	1,0	1,6	1	N49.05863	E11.95813	335	DEU
	U2946	subsp. *dioica*	LR	0,573	4	1,2	1,4	1	N49.05863	E11.95813	335	DEU
UP0781	U2947	subsp. *dioica*	LR	0,577	4	1,1	1,9	1	N49.39000	E10.84357	281	DEU
	U2948	subsp. *dioica*	LR	0,574	4	1,2	1,9	1	N49.39000	E10.84357	281	DEU
	U2949	subsp. *dioica*	LR	0,569	4	1,0	1,7	1	N49.39000	E10.84357	281	DEU
	U2950	subsp. *dioica*	LR	0,573	4	0,9	1,4	1	N49.39000	E10.84357	281	DEU
	U2951	subsp. *dioica*	LR	0,565	4	1,2	1,9	1	N49.39000	E10.84357	281	DEU
UP0782	U2952	subsp. *dioica*	LR	0,561	4	0,8	1,7	1	N49.97610	E10.17870	209	DEU
	U2953	subsp. *dioica*	LR	0,567	4	1,2	1,6	1	N49.97610	E10.17870	209	DEU
	U2954	subsp. *dioica*	LR	0,570	4	1,1	1,7	1	N49.97610	E10.17870	209	DEU
	U2955	subsp. *dioica*	LR	0,574	4	1,0	1,4	1	N49.97610	E10.17870	209	DEU
	U2956	subsp. *subinermis*	LR	0,305	2	1,4	2,9	1	N49.97610	E10.17870	209	DEU
	U2978	subsp. *subinermis*	LR	0,295	2	0,9	2,4	1	N49.97610	E10.17870	209	DEU
UP0783	U2957	subsp. *dioica*	LR	0,562	4	1,1	1,4	1	N49.76927	E9.34690	121	DEU
	U2958	subsp. *dioica*	LR	0,560	4	1,2	1,4	1	N49.76927	E9.34690	121	DEU
	U2959	subsp. *dioica*	LR	0,558	4	1,2	1,4	1	N49.76927	E9.34690	121	DEU
	U2960	subsp. *dioica*	LR	0,574	4	1,2	1,7	1	N49.76927	E9.34690	121	DEU

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UP0784	U2961	subsp. *dioica*	LR	0,581	4	1,1	1,7	1	N49.81522	E8.45752	94	DEU
	U2962	subsp. *dioica*	LR	0,553	4	1,2	1,4	1	N49.81522	E8.45752	94	DEU
	U2963	subsp. *dioica*	LR	0,572	4	1,4	1,8	1	N49.81522	E8.45752	94	DEU
	U2964	subsp. *subinermis*	LR	0,299	2	1,3	2,6	1	N49.81522	E8.45752	94	DEU
	U2965	subsp. *dioica*	LR	0,573	4	1,0	1,4	1	N49.81522	E8.45752	94	DEU
	U2966	subsp. *dioica*	LR	0,569	4	1,3	1,7	1	N49.81522	E8.45752	94	DEU
	U2967	subsp. *dioica*	LR	0,575	4	1,2	1,6	1	N49.81522	E8.45752	94	DEU
UP0785	U2968	subsp. *dioica*	LR	0,563	4	0,9	1,4	1	N51.06280	E6.89218	29	DEU
	U2969	subsp. *dioica*	LR	0,568	4	1,0	1,3	1	N51.06280	E6.89218	29	DEU
	U2970	subsp. *dioica*	LR	0,566	4	1,0	0,8	1	N51.06280	E6.89218	29	DEU
	U2971	subsp. *dioica*	LR	0,564	4	1,1	1,6	1	N51.06280	E6.89218	29	DEU
	U2972	subsp. *dioica*	LR	0,570	4	1,0	1,4	1	N51.06280	E6.89218	29	DEU
	U2973	subsp. *dioica*	LR	0,566	4	1,2	1,7	1	N51.06280	E6.89218	29	DEU
	U2974	subsp. *dioica*	LR	0,561	4	1,0	1,6	1	N51.06280	E6.89218	29	DEU
	U2975	subsp. *dioica*	LR	0,558	4	1,2	2,1	1	N51.06280	E6.89218	29	DEU
	U2976	subsp. *dioica*	LR	0,561	4	1,1	1,7	1	N51.06280	E6.89218	29	DEU
	U2977	subsp. *dioica*	LR	0,564	4	1,2	2,0	1	N51.06280	E6.89218	29	DEU
UP0786	U2979	subsp. *subinermis*	TU	0,304	2	0,6	2,1	1	N48.84767	E16.72642	160	CZE
	U3595	subsp. *subinermis*	LR	0,294	2	1,7	2,5	1	N48.84767	E16.72642	168	CZE
	U3596	subsp. *subinermis*	LR	0,292	2	1,8	2,2	1	N48.84767	E16.72642	168	CZE
	U3597	subsp. *subinermis*	LR	0,295	2	1,8	2,2	1	N48.84767	E16.72642	168	CZE
	U3682	subsp. *subinermis*	TU	0,297	2	0,6	2,2	1	N48.84767	E16.72642	160	CZE
	U3683	subsp. *subinermis*	TU	0,304	2	0,7	1,8	1	N48.84767	E16.72642	160	CZE
	U3684	subsp. *subinermis*	TU	0,294	2	0,5	2,1	1	N48.84767	E16.72642	160	CZE
	U3685	subsp. *subinermis*	TU	0,297	2	0,8	1,9	1	N48.84767	E16.72642	160	CZE
	U3686	subsp. *subinermis*	TU	0,301	2	0,8	1,8	1	N48.84767	E16.72642	160	CZE
	U3687	subsp. *subinermis*	TU	0,302	2	0,8	2,3	1	N48.84767	E16.72642	160	CZE
	U3688	subsp. *subinermis*	TU	0,297	2	0,8	2,1	1	N48.84767	E16.72642	160	CZE
	U3689	subsp. *subinermis*	TU	0,299	2	0,8	1,7	1	N48.84767	E16.72642	160	CZE
	U3690	subsp. *subinermis*	TU	0,299	2	0,8	2,0	1	N48.84767	E16.72642	160	CZE
	U3691	subsp. *subinermis*	TU	0,299	2	0,9	2,0	1	N48.84767	E16.72642	160	CZE
	U3692	subsp. *subinermis*	TU	0,297	2	0,6	2,1	1	N48.84767	E16.72642	160	CZE
	U3693	subsp. *subinermis*	TU	0,308	2	1,1	2,9	1	N48.84767	E16.72642	160	CZE
	U3694	subsp. *subinermis*	TU	0,299	2	0,8	1,4	1	N48.84767	E16.72642	160	CZE
	U3695	subsp. *subinermis*	TU	0,299	2	0,7	2,1	1	N48.84767	E16.72642	160	CZE
	U3696	subsp. *subinermis*	TU	0,303	2	0,9	1,9	1	N48.84767	E16.72642	160	CZE
	U3697	subsp. *subinermis*	TU	0,303	2	1,0	1,8	1	N48.84767	E16.72642	160	CZE
	U3698	subsp. *subinermis*	TU	0,298	2	0,8	2,1	1	N48.84767	E16.72642	160	CZE
UP0787	U2981	subsp. *dioica*	CP	0,559	4	0,9	1,1	1	N41.26139	E20.53528	1820	MKD
	U2982	subsp. *dioica*	CP	0,586	4	0,7	2,4	1	N41.26139	E20.53528	1820	MKD
	U2983	subsp. *dioica*	CP	0,573	4	0,7	1,5	1	N41.26139	E20.53528	1820	MKD

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UP0788	U2984	subsp. *dioica*	CP	0,580	4	0,7	2,4	1	N47.50005	E24.79859	1342	ROU
	U2985	subsp. *dioica*	CP	0,581	4	0,7	1,8	1	N47.50005	E24.79859	1342	ROU
	U2986	subsp. *dioica*	CP	0,585	4	0,7	2,3	1	N47.50005	E24.79859	1342	ROU
	U2987	subsp. *dioica*	CP	0,586	4	0,7	2,3	1	N47.50005	E24.79859	1342	ROU
	U2988	subsp. *dioica*	CP	0,582	4	0,7	1,3	1	N47.50005	E24.79859	1342	ROU
UP0789	U2989	subsp. *dioica*	CP	0,573	4	0,7	1,5	1	N47.45533	E12.37121	810	AUT
	U2990	subsp. *dioica*	CP	0,570	4	0,8	1,6	1	N47.45533	E12.37121	810	AUT
	U2991	subsp. *dioica*	CP	0,575	4	0,9	1,6	1	N47.45533	E12.37121	810	AUT
	U2992	subsp. *dioica*	CP	0,566	4	0,8	1,1	1	N47.45533	E12.37121	810	AUT
	U2993	subsp. *dioica*	CP	0,571	4	0,8	1,7	1	N47.45533	E12.37121	810	AUT
	U2994	subsp. *dioica*	CP	0,576	4	1,1	2,0	1	N47.45533	E12.37121	810	AUT
UP0790	U2995	subsp. *dioica*	CP	0,576	4	0,9	1,6	1	N48.09917	E24.47000	770	UKR
	U2996	subsp. *dioica*	CP	0,584	4	0,6	1,6	1	N48.09917	E24.47000	770	UKR
	U2997	subsp. *dioica*	CP	0,572	4	0,7	1,9	1	N48.09917	E24.47000	770	UKR
	U2998	subsp. *dioica*	CP	0,586	4	0,8	1,5	1	N48.09917	E24.47000	770	UKR
UP0791	U2999	subsp. *dioica*	CP	0,581	4	0,9	1,5	1	N47.70171	E15.73974	1730	AUT
	U3000	subsp. *dioica*	CP	0,573	4	0,9	1,6	1	N47.70171	E15.73974	1730	AUT
	U3001	subsp. *dioica*	CP	0,583	4	0,8	1,6	1	N47.70171	E15.73974	1730	AUT
	U3002	subsp. *dioica*	CP	0,600	4	0,7	1,8	1	N47.70171	E15.73974	1730	AUT
	U3003	subsp. *dioica*	CP	0,578	4	0,8	1,8	1	N47.70171	E15.73974	1730	AUT
	U3004	subsp. *dioica*	CP	0,575	4	0,8	1,3	1	N47.70171	E15.73974	1730	AUT
	U3005	subsp. *dioica*	CP	0,575	4	0,9	1,3	1	N47.70171	E15.73974	1730	AUT
	U3006	subsp. *dioica*	CP	0,572	4	1,0	1,8	1	N47.70171	E15.73974	1730	AUT
	U3007	subsp. *dioica*	CP	0,573	4	0,7	1,5	1	N47.70171	E15.73974	1730	AUT
	U3008	subsp. *dioica*	CP	0,585	4	0,9	1,6	1	N47.70171	E15.73974	1730	AUT
UP0792	U3023	U. *kioviensis*	TU	0,343	2	0,6	1,8	1	N48.94404	E16.59074	160	CZE
	U3024	U. *kioviensis*	TU	0,343	2	1,3	2,2	1	N48.94404	E16.59074	160	CZE
	U3025	U. *kioviensis*	TU	0,320	2	1,1	2,1	1	N48.94404	E16.59074	160	CZE
	U3026	U. *kioviensis*	TU	0,321	2	1,1	2,1	1	N48.94404	E16.59074	160	CZE
	U3027	U. *kioviensis*	TU	0,339	2	0,6	1,8	1	N48.94404	E16.59074	160	CZE
	U3028	U. *kioviensis*	TU	0,342	2	0,8	1,7	1	N48.94404	E16.59074	160	CZE
	U3029	U. *kioviensis*	TU	0,337	2	1,0	2,3	1	N48.94404	E16.59074	160	CZE
	U3030	U. *kioviensis*	TU	0,339	2	0,7	1,7	1	N48.94404	E16.59074	160	CZE
	U3031	U. *kioviensis*	TU	0,337	2	0,8	2,0	1	N48.94404	E16.59074	160	CZE
	U3032	U. *kioviensis*	TU	0,322	2	1,0	1,7	1	N48.94404	E16.59074	160	CZE
	U3033	U. *kioviensis*	TU	0,343	2	0,7	2,0	1	N48.94404	E16.59074	160	CZE
	U3034	U. *kioviensis*	TU	0,336	2	0,9	2,0	1	N48.94404	E16.59074	160	CZE
	U3724	subsp. *dioica*	TU	0,567	4	1,0	1,3	1	N48.94404	E16.59074	160	CZE
	U3725	subsp. *subinermis*	TU	0,322	2	0,9	1,7	1	N48.94404	E16.59074	160	CZE
	U3726	subsp. *subinermis*	TU	0,302	2	0,8	2,2	1	N48.94404	E16.59074	160	CZE
	U3727	subsp. *subinermis*	TU	0,299	2	0,7	2,2	1	N48.94404	E16.59074	160	CZE

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	U3728	subsp. *subinermis*	TU	0,293	2	0,7	1,9	1	N48.94404	E16.59074	160	CZE
	U3729	subsp. *subinermis*	TU	0,302	2	0,5	2,3	1	N48.94404	E16.59074	160	CZE
	U3730	subsp. *dioica*	TU	0,557	4	0,6	1,2	1	N48.94404	E16.59074	160	CZE
	U3731	subsp. *subinermis*	TU	0,300	2	0,6	1,7	1	N48.94404	E16.59074	160	CZE
	U3732	subsp. *dioica*	TU	0,566	4	0,7	1,2	1	N48.94404	E16.59074	160	CZE
	U3733	subsp. *dioica*	TU	0,568	4	1,0	1,3	1	N48.94404	E16.59074	160	CZE
	U3734	subsp. *dioica*	TU	0,565	4	1,0	1,6	1	N48.94404	E16.59074	160	CZE
	U3735	subsp. *dioica*	TU	0,574	4	1,0	1,3	1	N48.94404	E16.59074	160	CZE
	U3736	subsp. *subinermis*	TU	0,324	2	0,6	2,0	1	N48.94404	E16.59074	160	CZE
	U3737	subsp. *subinermis*	TU	0,327	2	0,7	2,2	1	N48.94404	E16.59074	160	CZE
	U3738	subsp. *dioica*	TU	0,573	4	1,0	1,0	1	N48.94404	E16.59074	160	CZE
	U3739	subsp. *dioica*	TU	0,576	4	0,7	1,0	1	N48.94404	E16.59074	160	CZE
	U3740	subsp. *subinermis*	TU	0,298	2	0,7	2,0	1	N48.94404	E16.59074	160	CZE
UP0793	U3047	subsp. *dioica*	LR	0,560	4	1,4	1,7	5	N49.68920	E15.10983	432	CZE
	U3078	subsp. *dioica*	LR	0,560	4	1,2	1,2	1	N49.68920	E15.10983	432	CZE
	U3079	subsp. *dioica*	LR	0,564	4	0,9	1,0	1	N49.68920	E15.10983	432	CZE
	U3080	subsp. *dioica*	LR	0,544	4	0,5	0,9	1	N49.68920	E15.10983	432	CZE
	U3081	subsp. *dioica*	LR	0,569	4	0,9	1,6	1	N49.68920	E15.10983	432	CZE
UP0794	U3048	subsp. *dioica*	LR	0,560	4	1,7	1,9	3	N49.51457	E15.41653	616	CZE
UP0795	U3049	subsp. *dioica*	LR	0,552	4	2,2	2,3	3	N49.14113	E16.20512	298	CZE
UP0796	U3050	subsp. *dioica*	RB	0,562	4	2,7	2,9	5	N48.82570	E16.09330	268	CZE
UP0797	U3051	subsp. *dioica*	RB	0,559	4	1,4	2,3	5	N48.84175	E16.12119	213	CZE
UP0798	U3052	subsp. *dioica*	RB	0,562	4	2,0	2,2	5	N49.13652	E16.97326	253	CZE
UP0799	U3053	subsp. *dioica*	RB	0,564	4	1,6	2,5	5	N49.15578	E16.92359	276	CZE
UP0800	U3054	subsp. *dioica*	RB	0,554	4	1,6	2,0	5	N49.19459	E16.92602	292	CZE
UP0801	U3055	subsp. *dioica*	RB	0,569	4	1,7	1,8	5	N49.17022	E16.88927	356	CZE
UP0802	U3056	subsp. *dioica*	RB	0,568	4	1,8	2,3	5	N49.71465	E16.25503	570	CZE
UP0803	U3057	subsp. *dioica*	RB	0,560	4	1,5	1,8	5	N49.04737	E16.32021	307	CZE
UP0804	U3058	subsp. *dioica*	RB	0,571	4	1,7	1,7	3	N49.17138	E16.40997	298	CZE
	U3141	subsp. *dioica*	RB	0,567	4	1,3	1,2	1	N49.17138	E16.40997	298	CZE
	U3142	subsp. *dioica*	RB	0,564	4	0,9	1,3	1	N49.17138	E16.40997	298	CZE
	U3143	subsp. *dioica*	RB	0,562	4	0,9	1,2	1	N49.17138	E16.40997	298	CZE
	U3144	subsp. *dioica*	RB	0,567	4	0,9	1,3	1	N49.17138	E16.40997	298	CZE
UP0805	U3059	subsp. *dioica*	RB	0,562	4	0,9	1,2	4	N49.57450	E17.27853	211	CZE
UP0806	U3060	subsp. *dioica*	RB	0,561	4	1,7	1,6	4	N49.82717	E16.10019	475	CZE
UP0807	U3061	subsp. *dioica*	PK	0,576	4	1,7	1,6	5	N49.94096	E14.20423	369	CZE
	U3062	subsp. *dioica*	PK	0,571	4	1,1	1,9	5	N49.94096	E14.20423	369	CZE
	U3063	subsp. *dioica*	PK	0,565	4	1,0	1,5	5	N49.94096	E14.20423	369	CZE
	U3064	subsp. *dioica*	PK	0,567	4	0,9	1,4	5	N49.94096	E14.20423	369	CZE
UP0808	U3065	subsp. *dioica*	PK	0,571	4	1,3	1,6	5	N50.01982	E15.30019	204	CZE
	U3066	subsp. *dioica*	PK	0,564	4	1,2	1,6	5	N50.01982	E15.30019	204	CZE

ID number of population	ID number of analysis	Taxon	Collector	Relative fluorescence intensity	DNA-ploidy level	CV of standard	CV of sample	N. of individuals in analysis	Latitude (WGS-84)	Longitude (WGS-84)	Altitude (m a.s.l.)	Country (ISO 3166-1)
	U3067	subsp. *dioica*	PK	0,563	4	1,3	1,5	5	N50.01982	E15.30019	204	CZE
UP0809	U3068	subsp. *dioica*	PK	0,573	4	1,3	1,6	7	N50.14887	E15.05279	186	CZE
	U3069	subsp. *dioica*	PK	0,570	4	1,9	1,7	7	N50.14887	E15.05279	186	CZE
	U3070	subsp. *dioica*	PK	0,574	4	1,0	1,7	7	N50.14887	E15.05279	186	CZE
	U3070	subsp. *dioica*	PK	0,570	4	1,2	2,0	7	N50.14887	E15.05279	186	CZE
	U3071	subsp. *dioica*	PK	0,568	4	1,2	1,4	7	N50.14887	E15.05279	186	CZE
UP0810	U3072	subsp. *dioica*	PK	0,569	4	1,0	1,7	6	N50.11408	E15.17422	197	CZE
	U3073	subsp. *dioica*	PK	0,567	4	1,1	1,7	5	N50.11408	E15.17422	197	CZE
	U3074	subsp. *dioica*	PK	0,569	4	1,3	1,7	5	N50.11408	E15.17422	197	CZE
UP0811	U3075	subsp. *dioica*	PK	0,560	4	1,3	1,6	6	N49.42504	E14.60711	459	CZE
	U3076	subsp. *dioica*	PK	0,566	4	1,3	1,5	6	N49.42504	E14.60711	459	CZE
	U3077	subsp. *dioica*	PK	0,566	4	1,5	1,5	6	N49.42504	E14.60711	459	CZE
UP0812	U3082	subsp. *dioica*	PK	0,561	4	0,8	1,1	1	N49.25892	E13.87251	404	CZE
	U3083	subsp. *dioica*	PK	0,563	4	0,6	1,2	1	N49.25892	E13.87251	404	CZE
	U3084	subsp. *dioica*	PK	0,570	4	0,9	0,9	1	N49.25892	E13.87251	404	CZE
	U3085	subsp. *dioica*	PK	0,566	4	0,7	1,2	1	N49.25892	E13.87251	404	CZE
	U3086	subsp. *dioica*	PK	0,565	4	0,8	1,0	1	N49.25892	E13.87251	404	CZE
	U3087	subsp. *dioica*	PK	0,572	4	0,8	1,3	1	N49.25892	E13.87251	404	CZE
	U3088	subsp. *dioica*	PK	0,572	4	0,7	0,9	1	N49.25892	E13.87251	404	CZE
	U3089	subsp. *dioica*	PK	0,558	4	0,9	1,0	1	N49.25892	E13.87251	404	CZE
	U3090	subsp. *dioica*	PK	0,575	4	0,8	1,0	1	N49.25892	E13.87251	404	CZE
	U3091	subsp. *dioica*	PK	0,562	4	0,8	0,9	1	N49.25892	E13.87251	404	CZE
	U3092	subsp. *dioica*	PK	0,575	4	0,8	1,3	1	N49.25892	E13.87251	404	CZE
	U3093	subsp. *dioica*	PK	0,557	4	0,9	1,4	1	N49.25892	E13.87251	404	CZE
	U3094	subsp. *dioica*	PK	0,581	4	0,9	1,0	1	N49.25892	E13.87251	404	CZE
	U3095	subsp. *dioica*	PK	0,562	4	0,9	1,3	1	N49.25892	E13.87251	404	CZE
	U3096	subsp. *dioica*	PK	0,566	4	0,8	1,3	1	N49.25892	E13.87251	404	CZE
UP0813	U3097	subsp. *dioica*	PK	0,567	4	1,0	1,9	6	N49.26610	E13.83792	407	CZE
	U3098	subsp. *dioica*	PK	0,563	4	0,7	1,6	6	N49.26610	E13.83792	407	CZE
UP0814	U3099	subsp. *dioica*	LR	0,569	4	1,0	1,3	5	N48.65250	E14.23163	906	CZE
UP0815	U3100	subsp. *dioica*	LR	0,578	4	0,7	1,4	4	N48.79795	E14.30685	498	CZE
UP0816	U3101	subsp. *dioica*	PK	0,563	4	0,9	1,1	6	N49.27280	E13.61885	446	CZE
UP0817	U3103	subsp. *dioica*	LR	0,579	4	1,4	1,6	5	N50.19858	E15.96122	237	CZE
UP0818	U3104	subsp. *dioica*	LR	0,571	4	1,3	1,9	5	N50.01925	E16.33586	446	CZE
UP0819	U3105	subsp. *dioica*	LR	0,567	4	1,2	1,7	5	N49.99964	E16.25142	312	CZE
UP0820	U3106	subsp. *dioica*	RB	0,573	4	1,0	1,3	2	N49.45531	E15.59381	523	CZE
UP0821	U3107	subsp. *dioica*	LR	0,566	4	1,0	1,5	5	N50.08644	E16.11394	258	CZE
UP0822	U3108	subsp. *dioica*	LR	0,570	4	1,7	1,7	5	N50.08944	E16.11253	259	CZE
UP0823	U3109	subsp. *dioica*	LR	0,577	4	1,5	1,7	5	N50.11583	E15.80078	222	CZE
UP0824	U3110	subsp. *dioica*	PV, TU	0,569	4	1,2	1,2	1	N52.56075	E14.67413	13	POL
	U3111	U. *kioviensis*	PV, TU	0,342	2	1,1	1,8	1	N52.56075	E14.67413	13	POL

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UP0825	U3112	subsp. *dioica*	JB	0,565	4	1,3	1,6	1	N48.90424	E14.29547	509	CZE
	U3113	subsp. *dioica*	JB	0,633	4	0,6	1,4	1	N48.90424	E14.29547	509	CZE
	U3114	subsp. *dioica*	JB	0,555	4	0,9	1,5	1	N48.90424	E14.29547	509	CZE
	U3115	subsp. *dioica*	JB	0,573	4	1,0	1,6	1	N48.90424	E14.29547	509	CZE
	U3116	subsp. *dioica*	JB	0,572	4	1,0	1,7	1	N48.90424	E14.29547	509	CZE
UP0826	U3117	subsp. *dioica*	FK	0,566	4	0,8	1,2	5	N44.17975	E19.87119	478	SRB
UP0827	U3118	subsp. *dioica*	FK	0,553	4	0,8	1,2	8	N45.41035	E22.77623	714	ROU
UP0828	U3119	subsp. *dioica*	LR	0,567	4	1,0	1,5	5	N50.19314	E15.97994	239	CZE
	U3135	subsp. *dioica*	LR	0,570	4	1,2	1,8	5	N50.19314	E15.97994	239	CZE
UP0829	U3120	subsp. *dioica*	JA	0,569	4	1,2	1,7	5	N50.23862	E12.69942	485	CZE
	U3677	subsp. *dioica*	JA	0,568	4	1,6	1,8	5	N50.23862	E12.69942	485	CZE
UP0830	U3121	subsp. *dioica*	RB	0,563	4	1,2	1,6	5	N50.56285	E13.97431	541	CZE
UP0831	U3122	subsp. *dioica*	RB	0,576	4	1,0	1,8	4	N48.86118	E16.64640	343	CZE
UP0832	U3123	subsp. *dioica*	RB	0,570	4	1,1	1,8	5	N48.85559	E16.64462	340	CZE
UP0833	U3124	subsp. *dioica*	RB	0,569	4	1,0	1,7	5	N48.82614	E16.64158	353	CZE
UP0834	U3125	subsp. *dioica*	LR	0,584	4	0,9	1,2	5	N46.91975	E13.57945	906	AUT
UP0835	U3126	subsp. *dioica*	LR	0,577	4	0,9	1,2	5	N46.43998	E14.02674	581	SVN
UP0836	U3127	subsp. *dioica*	LR	0,580	4	0,7	1,1	5	N45.08062	E13.64661	29	HRV
UP0837	U3128	subsp. *dioica*	LR	0,581	4	1,3	1,0	5	N46.57303	E13.83565	531	AUT
UP0838	U3129	subsp. *dioica*	RB	0,566	4	0,7	1,3	2	N50.15679	E19.93557	349	POL
UP0839	U3130	subsp. *dioica*	RB	0,570	4	0,7	1,0	2	N50.06128	E19.94756	211	POL
UP0840	U3131	subsp. *dioica*	RB	0,577	4	0,8	1,1	4	N51.10492	E17.03820	122	POL
UP0841	U3132	subsp. *dioica*	RB	0,579	4	0,7	1,2	5	N50.34983	E14.49229	171	CZE
UP0842	U3133	subsp. *dioica*	RB	0,567	4	0,5	1,2	6	N50.34702	E14.49882	174	CZE
UP0843	U3134	subsp. *dioica*	RB	0,570	4	0,8	0,9	5	N50.33936	E14.53998	189	CZE
UP0844	U3136	subsp. *dioica*	RB	0,558	4	0,6	1,1	5	N50.52807	E15.09166	246	CZE
UP0845	U3137	subsp. *dioica*	RB	0,563	4	0,9	1,1	6	N50.59446	E14.88859	388	CZE
UP0846	U3138	subsp. *dioica*	RB	0,573	4	1,4	1,4	5	N49.01844	E14.77760	432	CZE
UP0847	U3139	subsp. *dioica*	RB	0,561	4	1,0	1,3	5	N50.33404	E13.08063	440	CZE
UP0848	U3140	subsp. *dioica*	RB	0,558	4	1,8	2,3	5	N49.32543	E15.32009	605	CZE
UP0849	U3145	subsp. *dioica*	RB	0,566	4	0,7	1,3	4	N48.81258	E15.98163	258	CZE
UP0850	U3146	subsp. *dioica*	RB	0,568	4	1,0	1,4	5	N49.87268	E14.89729	290	CZE
UP0851	U3147	subsp. *dioica*	RB	0,570	4	0,9	1,4	1	N48.61134	E20.87384	344	SVK
	U3148	subsp. *dioica*	RB	0,563	4	1,0	1,3	4	N48.61134	E20.87384	344	SVK
UP0852	U3149	subsp. *dioica*	RB	0,573	4	0,9	1,4	3	N48.48742	E20.55065	227	HUN
UP0853	U3150	subsp. *dioica*	RB	0,572	4	0,8	1,3	3	N50.11890	E25.73972	365	UKR
UP0854	U3151	subsp. *dioica*	RB	0,557	4	0,9	1,5	2	N49.22437	E24.70292	313	UKR
UP0855	U3152	subsp. *dioica*	RB	0,572	4	1,0	2,0	3	N48.16205	E24.55347	1142	UKR
UP0856	U3153	subsp. *dioica*	RB	0,564	4	1,3	1,6	5	N48.63821	E26.78208	129	UKR
UP0857	U3154	subsp. *dioica*	RB	0,564	4	1,2	1,3	2	N48.13392	E27.16782	132	MDA
UP0858	U3155	subsp. *dioica*	RB	0,574	4	1,4	2,1	1	N47.80081	E27.28225	140	MDA

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	U3156	subsp. *dioica*	RB	0,559	4	0,8	1,3	1	N47.80081	E27.28225	140	MDA
	U3157	subsp. *dioica*	RB	0,583	4	0,9	1,9	1	N47.80081	E27.28225	140	MDA
UP0859	U3158	subsp. *dioica*	RB	0,573	4	0,8	1,4	4	N47.61506	E27.40441	53	MDA
UP0860	U3159	subsp. *dioica*	RB	0,573	4	1,1	1,5	5	N47.62170	E27.39394	55	MDA
UP0861	U3160	subsp. *dioica*	RB	0,566	4	1,0	1,4	2	N47.35573	E27.37043	42	ROU
UP0862	U3161	subsp. *dioica*	JR	0,560	4	0,8	0,9	1	N49.13645	E16.23324	269	CZE
UP0863	U3162	subsp. *dioica*	LR	0,584	4	1,7	1,5	5	N50.15028	E16.06439	248	CZE
	U3175	subsp. *dioica*	LR	0,575	4	1,2	1,6	5	N50.15028	E16.06439	248	CZE
UP0864	U3163	subsp. *dioica*	RB	0,575	4	1,0	1,4	2	N46.68166	E25.39290	809	ROU
UP0865	U3164	subsp. *dioica*	RB	0,564	4	1,6	1,7	5	N46.38212	E23.58089	481	ROU
UP0866	U3165	subsp. *dioica*	TU	0,571	4	0,7	1,1	1	N48.64958	E20.44265	528	SVK
UP0867	U3166	subsp. *dioica*	TU	0,575	4	0,9	1,4	3	N48.87204	E16.65778	409	CZE
UP0868	U3167	subsp. *dioica*	TU	0,558	4	1,2	1,1	1	N49.17553	E20.26463	1065	SVK
UP0869	U3168	subsp. *dioica*	TU	0,571	4	1,0	1,5	5	N49.84083	E14.81361	461	CZE
UP0870	U3169	subsp. *dioica* triploid	GF	0,438	3	0,9	1,3	1	N49.72099	E15.71472	514	CZE
	U3170	subsp. *dioica*	GF	0,571	4	0,8	1,6	1	N49.72099	E15.71472	514	CZE
	U3171	subsp. *dioica*	GF	0,571	4	0,8	1,1	1	N49.72099	E15.71472	514	CZE
	U3172	subsp. *dioica*	GF	0,566	4	0,8	1,2	1	N49.72099	E15.71472	514	CZE
	U3173	subsp. *dioica* triploid	GF	0,445	3	0,9	1,5	1	N49.72099	E15.71472	514	CZE
	U3174	subsp. *dioica* triploid	GF	0,459	3	0,8	1,4	1	N49.72099	E15.71472	514	CZE
UP0871	U3176	subsp. *dioica*	TU	0,565	4	0,7	1,5	4	N50.80572	E14.54061	499	CZE
UP0872	U3177	subsp. *dioica*	TU	0,559	4	1,2	1,4	5	N50.28585	E14.34354	167	CZE
UP0873	U3178	subsp. *dioica*	TU	0,572	4	1,2	1,3	5	N50.29267	E14.34354	171	CZE
UP0874	U3179	subsp. *dioica*	TU	0,568	4	1,3	1,4	5	N50.29935	E14.33206	166	CZE
UP0875	U3180	subsp. *dioica*	TU	0,567	4	1,5	1,5	5	N50.31619	E14.43294	160	CZE
	U3181	subsp. *dioica*	TU	0,572	4	1,7	1,5	5	N50.31619	E14.43294	160	CZE
UP0876	U3182	subsp. *dioica*	TU	0,549	4	1,4	2,4	5	N50.31776	E14.44203	161	CZE
UP0877	U3183	subsp. *dioica*	TU	0,560	4	1,4	1,7	5	N50.32178	E14.43966	163	CZE
	U3184	subsp. *dioica*	TU	0,563	4	1,2	1,7	5	N50.32178	E14.43966	163	CZE
UP0878	U3186	subsp. *dioica*	LR	0,568	4	1,0	1,5	5	N50.10339	E16.28047	293	CZE
UP0879	U3187	subsp. *dioica*	RB	0,543	4	1,7	1,7	3	N48.99055	E19.28263	574	SVK
UP0880	U3188	subsp. *dioica*	LR	0,565	4	1,0	1,4	5	N50.09067	E16.36800	386	CZE
	U3194	subsp. *dioica*	LR	0,560	4	1,2	1,4	5	N50.09067	E16.36800	386	CZE
	U3195	subsp. *dioica*	LR	0,570	4	1,4	1,6	5	N50.09067	E16.36800	386	CZE
UP0881	U3189	subsp. *dioica*	RB	0,564	4	1,1	2,1	2	N49.04667	E19.28872	734	SVK
UP0882	U3190	subsp. *dioica*	RB	0,550	4	1,2	1,0	1	N48.98867	E19.30307	806	SVK
	U3191	subsp. *dioica*	RB	0,557	4	1,2	1,5	1	N48.98867	E19.30307	806	SVK
	U3192	subsp. *dioica*	RB	0,560	4	1,3	1,9	1	N48.98867	E19.30307	806	SVK
	U3193	subsp. *dioica*	RB	0,559	4	1,3	1,5	1	N48.98867	E19.30307	806	SVK
	U3205	subsp. *dioica*	SP	0,569	4	1,5	1,8	1	N48.98867	E19.30307	806	SVK
UP0883	U3196	subsp. *dioica*	TU	0,551	4	1,1	1,7	1	N48.37417	E16.23819	170	AUT

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UP0884	U3198	subsp. *dioica*	TU	0,548	4	1,4	1,8	1	N47.49108	E16.27989	432	AUT
UP0885	U3200	subsp. *dioica*	TF	0,563	4	1,7	1,4	1	N49.07515	E12.10112	331	DEU
UP0886	U3201	subsp. *dioica*	AR	0,611	4	0,8	1,5	1	N51.12881	E17.05693	116	POL
UP0887	U3202	subsp. *dioica*	FK	0,577	4	1,0	1,4	1	N47.33497	E15.37219	494	AUT
UP0888	U3203	subsp. *dioica* aneuploid	FK	0,498	–	1,1	1,7	1	N47.14472	E15.87933	323	AUT
UP0889	U3204	subsp. *dioica*	FK	0,556	4	1,1	1,6	1	N49.95108	E13.75200	274	CZE
UP0890	U3206	subsp. *dioica*	RB	0,569	4	1,3	1,4	5	N47.77383	E14.17643	504	AUT
UP0891	U3207	subsp. *subinermis*	JR	0,294	2	1,2	2,3	5	N50.91993	E14.13936	120	DEU
	U3208	subsp. *subinermis*	JR	0,294	2	1,7	2,2	5	N50.91993	E14.13936	120	DEU
	U3209	subsp. *subinermis*	JR	0,296	2	1,2	1,8	5	N50.91993	E14.13936	120	DEU
UP0892	U3210	subsp. *subinermis*	FK	0,294	2	0,8	1,6	1	N46.19805	E18.85195	96	HRV
	U3211	subsp. *subinermis*	FK	0,300	2	0,8	1,5	1	N46.19805	E18.85195	96	HRV
	U3212	subsp. *subinermis*	FK	0,303	2	0,8	1,6	1	N46.19805	E18.85195	96	HRV
	U3213	subsp. *subinermis*	FK	0,299	2	0,7	1,5	1	N46.19805	E18.85195	96	HRV
	U3214	subsp. *subinermis*	FK	0,302	2	0,7	1,7	1	N46.19805	E18.85195	96	HRV
	U3215	subsp. *subinermis*	FK	0,300	2	0,8	1,5	1	N46.19805	E18.85195	96	HRV
	U3216	subsp. *subinermis*	FK	0,298	2	0,7	1,5	1	N46.19805	E18.85195	96	HRV
UP0893	U3217	subsp. *dioica*	FK	0,561	4	1,2	1,7	5	N49.12150	E19.86643	854	SVK
UP0894	U3218	subsp. *dioica*	ML	0,560	4	0,7	1,3	3	N50.07736	E17.28493	900	CZE
UP0895	U3219	subsp. *dioica*	RB	0,563	4	1,1	1,5	6	N48.95079	E15.98788	338	CZE
UP0896	U3220	subsp. *dioica*	TU	0,563	4	1,2	1,3	5	N50.41453	E12.89964	960	CZE
UP0897	U3221	subsp. *dioica*	TU	0,563	4	1,2	1,7	5	N49.78692	E14.07747	621	CZE
UP0898	U3222	subsp. *dioica*	FK	0,569	4	1,0	1,4	5	N48.75449	E16.89148	157	CZE
UP0899	U3223	subsp. *dioica*	FK	0,579	4	1,4	1,4	5	N48.74169	E16.89697	157	CZE
UP0900	U3224	subsp. *dioica*	TU	0,579	4	0,9	1,4	5	N50.35739	E13.73881	187	CZE
UP0901	U3225	subsp. *dioica*	RB	0,550	4	0,8	1,4	5	N49.62909	E16.35100	604	CZE
UP0902	U3226	subsp. *dioica*	TU	0,556	4	1,1	1,3	3	N50.71825	E15.37809	713	CZE
UP0903	U3227	subsp. *dioica*	TU	0,559	4	0,9	1,3	4	N50.45511	E14.25619	170	CZE
UP0904	U3228	subsp. *dioica*	RB	0,563	4	1,3	2,1	5	N50.55802	E13.97288	437	CZE
UP0905	U3229	subsp. *dioica*	FK	0,563	4	1,1	1,6	5	N50.07910	E14.50827	231	CZE
UP0906	U3230	subsp. *dioica*	LR	0,578	4	1,4	1,3	2	N49.26048	E13.94343	389	CZE
UP0907	U3231	subsp. *dioica*	LR	0,578	4	1,1	1,6	2	N49.00606	E14.44152	380	CZE
UP0908	U3232	subsp. *dioica*	LR	0,581	4	1,4	1,4	2	N49.00696	E14.43152	383	CZE
UP0909	U3233	subsp. *dioica*	LR	0,566	4	1,7	1,2	1	N49.00358	E14.42556	388	CZE
UP0910	U3234	subsp. *dioica*	LR	0,583	4	1,2	1,7	2	N48.99767	E14.43062	387	CZE
UP0911	U3235	subsp. *dioica*	LR	0,562	4	1,6	1,7	2	N49.00071	E14.44023	383	CZE
UP0912	U3236	subsp. *dioica*	LR	0,571	4	1,3	1,5	2	N49.26085	E13.86634	406	CZE
UP0913	U3237	subsp. *dioica*	LR	0,558	4	1,5	1,8	3	N49.38078	E14.14253	440	CZE
UP0914	U3238	subsp. *dioica*	LR	0,576	4	1,4	1,7	2	N49.04866	E14.37496	383	CZE
UP0915	U3239	subsp. *dioica*	LR	0,571	4	1,2	1,5	2	N49.07183	E14.34664	383	CZE
UP0916	U3240	subsp. *dioica*	LR	0,573	4	1,2	1,6	1	N49.37681	E14.15171	424	CZE

ID number of population	ID number of analysis	Taxon	Collector	Relative fluorescence intensity	DNA-ploidy level	CV of standard	CV of sample	N. of individuals in analysis	Latitude (WGS-84)	Longitude (WGS-84)	Altitude (m a.s.l.)	Country (ISO 3166-1)
UP0917	U3241	subsp. *dioica*	LR	0,568	4	1,2	1,7	2	N49.37122	E14.15395	423	CZE
UP0918	U3242	subsp. *dioica*	LR	0,564	4	1,7	1,4	2	N49.37150	E14.14549	367	CZE
UP0919	U3243	subsp. *dioica*	RB	0,582	4	1,0	1,8	5	N48.97444	E14.46445	385	CZE
UP0920	U3244	subsp. *dioica*	GF	0,561	4	1,3	1,5	1	N50.64035	E14.98829	284	CZE
	U3245	subsp. *dioica*	GF	0,559	4	1,4	1,4	1	N50.64035	E14.98829	284	CZE
	U3246	subsp. *dioica*	GF	0,549	4	1,6	1,6	1	N50.64035	E14.98829	284	CZE
	U3247	subsp. *dioica*	GF	0,557	4	1,3	1,6	1	N50.64035	E14.98829	284	CZE
	U3248	subsp. *dioica*	GF	0,568	4	1,2	1,4	1	N50.64035	E14.98829	284	CZE
UP0921	U3249	subsp. *dioica*	RB	0,570	4	1,3	1,8	4	N49.89998	E14.39756	237	CZE
UP0922	U3250	subsp. *dioica*	TR	0,570	4	0,9	1,4	5	N49.88264	E14.39628	205	CZE
UP0923	U3251	subsp. *dioica*	RB	0,587	4	1,3	1,6	3	N48.87609	E16.66214	426	CZE
UP0924	U3252	subsp. *dioica*	PV	0,548	4	0,9	1,5	5	N49.97730	E14.75192	460	CZE
UP0925	U3253	subsp. *dioica*	ML	0,569	4	1,4	1,6	5	N49.46213	E17.47643	218	CZE
UP0926	U3254	subsp. *dioica*	LR	0,563	4	0,8	1,2	5	N49.34676	E14.51356	384	CZE
UP0927	U3255	subsp. *dioica*	RB	0,578	4	1,1	1,3	5	N48.88580	E16.64789	190	CZE
UP0928	U3256	subsp. *dioica*	VC	0,557	4	1,2	1,4	1	N49.70330	E14.03969	550	CZE
UP0929	U3257	subsp. *dioica*	MDU	0,570	4	0,8	1,3	5	N50.26531	E16.05317	269	CZE
	U3258	subsp. *dioica*	MDU	0,572	4	0,8	1,0	5	N50.26531	E16.05317	269	CZE
	U3259	subsp. *dioica*	MDU	0,573	4	0,6	1,3	5	N50.26531	E16.05317	269	CZE
	U3260	subsp. *dioica*	MDU	0,565	4	1,0	1,3	6	N50.26531	E16.05317	269	CZE
	U3261	subsp. *dioica*	MDU	0,576	4	0,7	2,9	6	N50.26531	E16.05317	269	CZE
UP0930	U3262	subsp. *dioica*	TF	0,565	4	1,4	1,4	1	N55.95204	W3.16316	40	GBR
UP0931	U3263	subsp. *dioica*	TF	0,573	4	1,0	1,7	5	N48.85816	E17.67861	947	SVK
UP0932	U3264	subsp. *dioica*	TF	0,576	4	1,8	1,2	5	N48.82013	E21.96971	185	SVK
UP0933	U3265	subsp. *dioica*	TF	0,572	4	1,2	1,4	5	N48.57732	E18.32049	216	SVK
UP0934	U3266	subsp. *dioica*	TF	0,571	4	1,0	1,4	5	N49.03207	E21.96094	191	SVK
UP0935	U3267	subsp. *dioica*	TF	0,576	4	1,2	1,9	5	N48.36513	E18.89477	441	SVK
UP0936	U3268	subsp. *dioica*	TF	0,567	4	1,4	1,7	5	N48.89003	E21.93593	236	SVK
UP0937	U3269	subsp. *dioica*	RB	0,550	4	1,9	3,5	5	N48.81071	E16.00906	289	CZE
UP0938	U3270	subsp. *dioica*	FK	0,569	4	1,1	1,6	5	N46.78772	E17.19184	112	HUN
UP0939	U3271	subsp. *subinermis*	RB	0,301	2	1,1	2,5	1	N48.88786	E17.07357	174	CZE
	U3272	subsp. *subinermis*	RB	0,299	2	1,2	2,3	1	N48.88786	E17.07357	174	CZE
	U3273	subsp. *subinermis*	RB	0,299	2	1,7	2,3	1	N48.88786	E17.07357	174	CZE
UP0940	U3274	subsp. *dioica*	TU	0,567	4	0,9	1,6	5	N48.60150	E16.93653	176	AUT
UP0941	U3275	subsp. *subinermis*	JR	0,292	2	1,1	2,2	1	N50.66874	E14.15891	136	CZE
	U3276	subsp. *subinermis*	JR	0,293	2	1,4	2,4	1	N50.66874	E14.15891	136	CZE
	U3277	subsp. *subinermis*	JR	0,294	2	1,0	2,4	1	N50.66874	E14.15891	136	CZE
	U3278	subsp. *subinermis*	JR	0,291	2	1,1	2,2	1	N50.66874	E14.15891	136	CZE
	U3279	subsp. *subinermis*	JR	0,293	2	1,3	2,5	1	N50.66874	E14.15891	136	CZE
	U3280	subsp. *subinermis*	JR	0,292	2	1,1	2,4	1	N50.66874	E14.15891	136	CZE
	U3281	subsp. *subinermis*	JR	0,291	2	1,3	1,2	1	N50.66874	E14.15891	136	CZE

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	U3282	subsp. *dioica*	JR	0,556	4	1,4	1,6	1	N50.66874	E14.15891	136	CZE
	U3283	subsp. *dioica*	JR	0,562	4	1,4	1,5	1	N50.66874	E14.15891	136	CZE
	U3284	subsp. *dioica*	JR	0,563	4	1,2	1,3	1	N50.66874	E14.15891	136	CZE
	U3285	subsp. *subinermis*	JR	0,293	2	1,8	2,0	1	N50.66874	E14.15891	136	CZE
	U3286	subsp. *dioica*	JR	0,578	4	1,2	1,6	1	N50.66874	E14.15891	136	CZE
	U3287	subsp. *subinermis*	JR	0,289	2	1,7	2,4	1	N50.66874	E14.15891	136	CZE
	U3288	subsp. *subinermis*	JR	0,293	2	1,2	1,6	1	N50.66874	E14.15891	136	CZE
	U3289	subsp. *dioica*	JR	0,561	4	1,1	1,8	1	N50.66874	E14.15891	136	CZE
	U3396	subsp. *subinermis*	JR	0,288	2	1,4	2,3	5	N50.66874	E14.15891	136	CZE
	U3397	subsp. *subinermis*	JR	0,291	2	1,3	2,6	5	N50.66874	E14.15891	136	CZE
	U3398	subsp. *subinermis*	JR	0,290	2	1,1	1,9	5	N50.66874	E14.15891	136	CZE
UP0942	U3290	subsp. *dioica*	TF	0,597	4	1,4	2,2	5	N48.47498	E17.86353	228	SVK
UP0943	U3291	subsp. *subinermis*	TU	0,298	2	0,9	1,6	5	N48.34689	E16.88764	157	AUT
	U3292	subsp. *subinermis*	TU	0,303	2	1,4	1,8	5	N48.34689	E16.88764	157	AUT
UP0944	U3293	subsp. *dioica*	MDU	0,559	4	0,7	1,4	8	N50.36028	E15.62312	294	CZE
	U3294	subsp. *dioica*	MDU	0,567	4	0,6	1,6	8	N50.36028	E15.62312	294	CZE
	U3295	subsp. *dioica*	MDU	0,570	4	0,7	1,0	8	N50.36028	E15.62312	294	CZE
UP0945	U3296	subsp. *dioica*	TU	0,557	4	1,3	1,6	2	N49.37670	E17.72349	425	CZE
	U3297	subsp. *dioica*	TU	0,558	4	1,1	1,8	3	N49.37670	E17.72349	440	CZE
UP0946	U3298	subsp. *dioica*	LR	0,568	4	1,8	2,0	5	N50.10058	E15.66736	223	CZE
UP0947	U3299	subsp. *dioica*	TF	0,575	4	1,4	1,7	5	N49.15480	E20.08446	1535	SVK
UP0948	U3303	subsp. *dioica*	JP	0,582	4	0,8	1,1	1	N36.67442	E54.46397	1325	IRN
UP0949	U3307	subsp. *dioica*	JB	0,563	4	0,9	1,3	3	N49.65922	E17.36294	378	CZE
UP0950	U3308	subsp. *dioica*	JB	0,572	4	0,8	0,9	3	N49.64206	E17.36981	429	CZE
UP0951	U3309	subsp. *dioica*	JB	0,566	4	0,7	1,3	4	N49.69091	E17.34414	396	CZE
UP0952	U3310	subsp. *dioica*	JB	0,566	4	0,9	1,2	5	N50.06786	E14.41941	198	CZE
UP0953	U3311	subsp. *dioica*	JB	0,566	4	1,4	1,3	5	N50.04413	E14.35345	269	CZE
UP0954	U3312	subsp. *dioica*	JR	0,559	4	0,9	0,9	4	N49.10071	E16.21351	254	CZE
UP0955	U3313	subsp. *dioica*	VR	0,564	4	2,0	2,8	1	N50.23044	E14.75086	176	CZE
UP0956	U3314	subsp. *dioica*	FK	0,559	4	1,1	1,3	5	N49.05976	E20.93043	656	SVK
UP0957	U3315	subsp. *dioica*	LR	0,574	4	0,8	0,9	5	N48.72969	E14.48100	559	CZE
UP0958	U3316	subsp. *dioica*	LR	0,573	4	0,9	1,2	5	N49.94004	E14.18800	288	CZE
UP0959	U3317	subsp. *dioica*	MD	0,584	4	1,0	2,0	1	N48.76503	E21.24214	229	SVK
UP0960	U3318	subsp. *dioica*	PT	0,572	4	1,1	1,5	5	N50.16823	E14.90592	177	CZE
UP0961	U3319	U. *kioviensis*	FK	0,336	2	0,8	1,5	1	N48.67931	E16.94617	173	CZE
UP0962	U3320	subsp. *dioica*	RB	0,561	4	1,1	1,8	5	N50.56554	E13.97277	597	CZE
UP0963	U3321	subsp. *dioica*	TU	0,564	4	1,0	1,4	3	N50.42578	E14.46278	183	CZE
UP0964	U3322	subsp. *dioica*	TF	0,559	4	1,8	2,4	5	N48.47394	E17.80484	141	SVK
UP0965	U3323	subsp. *dioica*	RB	0,564	4	1,2	1,6	2	N50.11530	E14.40732	180	CZE
UP0966	U3324	subsp. *dioica*	VC	0,558	4	1,1	1,4	1	N49.73486	E14.09411	417	CZE
UP0967	U3325	subsp. *dioica*	FK	0,564	4	1,5	1,7	5	N50.68489	E14.83344	390	CZE

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UP0968	U3326	subsp. *dioica*	TU	0,561	4	1,1	1,8	3	N50.65175	E15.35836	451	CZE
UP0969	U3327	subsp. *dioica*	TU	0,561	4	1,1	1,7	1	N50.71247	E15.42056	483	CZE
UP0970	U3328	subsp. *dioica*	VK	0,567	4	0,8	1,2	1	N50.85019	E14.65150	618	DEU
UP0971	U3329	subsp. *dioica*	VK	0,570	4	0,8	1,2	1	N50.58542	E16.11436	671	CZE
UP0972	U3330	subsp. *dioica*	VK	0,567	4	0,8	1,1	1	N50.65799	E15.59464	611	CZE
UP0973	U3331	subsp. *dioica*	VK	0,561	4	0,9	1,3	1	N50.69891	E15.59464	766	CZE
UP0974	U3332	subsp. *subinermis*	LR	0,299	2	1,0	2,3	5	N48.69703	E16.95969	154	CZE
UP0975	U3333	subsp. *dioica*	PT	0,571	4	0,8	1,6	5	N50.10632	E15.19024	201	CZE
UP0976	U3334	subsp. *dioica*	LM	0,558	4	1,2	1,7	5	N49.70647	E17.09705	232	CZE
UP0977	U3335	subsp. *dioica*	ML	0,558	4	0,7	1,4	7	N49.70834	E17.09481	230	CZE
UP0978	U3336	subsp. *dioica*	LR	0,567	4	0,7	1,2	4	N53.39834	W2.97262	38	GBR
UP0979	U3337	subsp. *dioica*	LM	0,565	4	0,9	1,1	1	N49.20809	E19.04139	763	SVK
UP0980	U3338	subsp. *dioica*	LR	0,561	4	0,9	2,3	5	N49.54238	E13.31842	356	CZE
UP0981	U3339	subsp. *dioica*	LR	0,562	4	1,3	1,5	5	N49.54525	E13.31770	356	CZE
UP0982	U3340	subsp. *dioica*	LR	0,550	4	1,6	2,9	5	N49.54452	E13.31932	355	CZE
UP0983	U3341	subsp. *dioica*	LR	0,570	4	1,7	2,1	5	N49.54418	E13.31867	356	CZE
UP0984	U3342	subsp. *dioica*	LR	0,553	4	1,5	1,7	5	N49.54433	E13.31732	356	CZE
UP0985	U3343	subsp. *dioica*	LR	0,559	4	1,4	1,8	5	N49.54362	E13.31695	356	CZE
UP0986	U3344	subsp. *dioica*	LR	0,572	4	1,0	1,7	5	N49.54310	E13.31847	357	CZE
UP0987	U3345	subsp. *dioica*	LR	0,567	4	1,2	1,6	5	N49.54335	E13.31875	356	CZE
UP0988	U3346	subsp. *dioica*	LR	0,577	4	1,2	1,6	5	N49.54575	E13.31997	359	CZE
	U3347	subsp. *dioica*	LR	0,568	4	1,3	1,6	5	N49.54575	E13.31997	359	CZE
	U3348	subsp. *dioica*	LR	0,598	4	1,2	1,8	5	N49.54575	E13.31997	359	CZE
	U3349	subsp. *dioica*	LR	0,563	4	1,3	1,5	5	N49.54575	E13.31997	359	CZE
	U3350	subsp. *dioica*	LR	0,556	4	0,9	1,8	5	N49.54575	E13.31997	359	CZE
	U3351	subsp. *dioica*	LR	0,574	4	1,1	1,5	5	N49.54575	E13.31997	359	CZE
	U3352	subsp. *dioica*	LR	0,573	4	1,0	1,6	5	N49.54575	E13.31997	359	CZE
	U3353	subsp. *dioica*	LR	0,584	4	1,2	2,3	5	N49.54575	E13.31997	359	CZE
	U3354	subsp. *dioica*	LR	0,576	4	1,2	1,5	5	N49.54575	E13.31997	359	CZE
	U3355	subsp. *dioica*	LR	0,572	4	1,4	1,7	5	N49.54575	E13.31997	359	CZE
	U3356	subsp. *dioica*	LR	0,580	4	0,8	1,8	5	N49.54575	E13.31997	359	CZE
	U3357	subsp. *dioica*	LR	0,580	4	1,7	1,6	5	N49.54575	E13.31997	359	CZE
	U3358	subsp. *dioica*	LR	0,575	4	1,4	1,7	5	N49.54575	E13.31997	359	CZE
	U3359	subsp. *dioica*	LR	0,574	4	1,4	1,8	5	N49.54575	E13.31997	359	CZE
UP0989	U3360	subsp. *dioica*	PK	0,576	4	1,3	1,4	5	N50.38570	E13.92320	181	CZE
	U3361	subsp. *dioica*	PK	0,573	4	1,1	1,5	5	N50.38570	E13.92320	181	CZE
	U3362	subsp. *dioica*	PK	0,580	4	1,2	1,6	5	N50.38570	E13.92320	181	CZE
	U3363	subsp. *dioica*	PK	0,573	4	1,2	1,6	5	N50.38570	E13.92320	181	CZE
	U3364	subsp. *dioica*	PK	0,575	4	1,3	1,9	5	N50.38570	E13.92320	181	CZE
UP0990	U3365	subsp. *dioica*	PK	0,573	4	1,2	1,7	4	N50.41556	E14.13972	162	CZE
	U3366	subsp. *dioica*	PK	0,572	4	1,2	1,9	5	N50.41556	E14.13972	162	CZE

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	U3367	subsp. *dioica*	PK	0,566	4	1,1	1,6	5	N50.41556	E14.13972	162	CZE
	U3368	subsp. *dioica*	PK	0,582	4	1,1	1,9	5	N50.41556	E14.13972	162	CZE
UP0991	U3369	subsp. *dioica*	TF	0,566	4	1,2	1,6	5	N49.07276	E18.58640	481	SVK
UP0992	U3370	subsp. *dioica*	LR	0,567	4	0,7	1,0	2	N53.48355	W2.23586	51	GBR
UP0993	U3371	subsp. *dioica*	GF	0,568	4	0,7	1,1	5	N50.55199	E16.34890	385	CZE
	U3372	subsp. *dioica*	GF	0,573	4	0,7	1,2	4	N50.55199	E16.34890	385	CZE
UP0994	U3376	subsp. *dioica*	TU	0,570	4	1,2	2,1	5	N50.43512	E13.75956	435	CZE
UP0995	U3377	subsp. *dioica*	TU	0,566	4	1,4	1,4	7	N50.55644	E13.92886	749	CZE
UP0996	U3378	subsp. *dioica*	LR	0,569	4	1,0	1,6	5	N50.12020	E16.50322	459	CZE
UP0997	U3379	subsp. *dioica*	RB	0,556	4	1,4	1,6	1	N49.10410	E16.18660	263	CZE
	U3380	subsp. *dioica*	RB	0,547	4	1,5	1,8	1	N49.10410	E16.18660	263	CZE
	U3381	subsp. *dioica*	RB	0,564	4	1,6	1,4	1	N49.10410	E16.18660	263	CZE
	U3382	subsp. *dioica*	RB	0,564	4	1,7	1,5	1	N49.10410	E16.18660	263	CZE
UP0998	U3383	subsp. *dioica*	RB	0,571	4	0,9	1,6	5	N47.34762	E13.30571	943	AUT
UP0999	U3384	subsp. *dioica*	LR	0,556	4	0,7	1,3	7	N49.01778	E16.64293	183	CZE
UP1000	U3385	subsp. *dioica*	LR	0,564	4	0,7	1,2	5	N48.78045	E16.70784	174	CZE
UP1001	U3386	subsp. *dioica*	LR	0,566	4	1,0	1,1	6	N48.81729	E16.77653	170	CZE
UP1002	U3387	subsp. *dioica*	LR	0,559	4	0,9	1,2	4	N48.81977	E16.78977	170	CZE
UP1003	U3388	subsp. *dioica*	LR	0,562	4	0,9	1,7	5	N48.81700	E16.78469	169	CZE
UP1004	U3389	subsp. *dioica*	LR	0,564	4	0,7	1,1	9	N48.76555	E16.85404	163	CZE
UP1005	U3390	subsp. *dioica*	LR	0,564	4	1,1	1,3	8	N48.76760	E16.86153	162	CZE
UP1006	U3391	subsp. *dioica*	LR	0,567	4	0,9	1,3	4	N48.80408	E17.09122	165	CZE
UP1007	U3392	subsp. *dioica*	LR	0,564	4	0,7	1,4	7	N48.93260	E17.28843	172	CZE
UP1008	U3393	subsp. *dioica*	LR	0,577	4	0,9	1,6	8	N48.89038	E15.91409	408	CZE
UP1009	U3394	subsp. *dioica*	LR	0,563	4	0,6	1,3	5	N49.08611	E16.72972	194	CZE
UP1010	U3395	subsp. *dioica*	LR	0,565	4	0,9	1,2	9	N48.84469	E16.68961	216	CZE
UP1011	U3400	subsp. *dioica*	FK	0,564	4	1,1	1,6	14	N52.61583	E1.24379	8	GBR
UP1012	U3401	subsp. *dioica*	FK	0,564	4	1,0	1,4	5	N50.48294	E15.50471	470	CZE
UP1013	U3402	subsp. *dioica*	TU	0,565	4	0,9	1,9	5	N50.72511	E15.21677	624	CZE
UP1014	U3403	subsp. *dioica*	LR	0,575	4	1,2	1,6	5	N49.62328	E17.90933	265	CZE
UP1015	U3404	subsp. *dioica*	LR	0,570	4	1,2	1,6	5	N49.66356	E17.99678	242	CZE
UP1016	U3405	subsp. *dioica*	LR	0,562	4	1,9	1,6	5	N49.67956	E18.02869	248	CZE
UP1017	U3406	subsp. *dioica*	LR	0,565	4	1,0	1,5	5	N49.67633	E18.02906	245	CZE
UP1018	U3407	subsp. *dioica*	LR	0,571	4	1,1	2,0	5	N49.71700	E18.12050	230	CZE
UP1019	U3408	subsp. *dioica*	LR	0,562	4	1,5	1,8	5	N49.71689	E18.12103	231	CZE
UP1020	U3409	subsp. *dioica*	LR	0,564	4	1,3	1,7	5	N49.71675	E18.12119	232	CZE
UP1021	U3410	subsp. *dioica*	LR	0,567	4	1,0	1,5	5	N49.62336	E17.90931	265	CZE
UP1022	U3411	subsp. *dioica*	LR	0,567	4	1,4	1,7	5	N49.62331	E17.90956	266	CZE
UP1023	U3412	subsp. *dioica*	LR	0,577	4	1,0	1,5	5	N49.62422	E17.94311	258	CZE
UP1024	U3413	subsp. *dioica*	LR	0,570	4	1,3	1,5	5	N49.62442	E17.94272	256	CZE
UP1025	U3414	subsp. *dioica*	LR	0,573	4	1,3	1,7	5	N49.62450	E17.94217	257	CZE

ID number of population	ID number of analysis	Taxon	Collector	Relative fluorescence intensity	DNA-ploidy level	CV of standard	CV of sample	N. of individuals in analysis	Latitude (WGS-84)	Longitude (WGS-84)	Altitude (m a.s.l.)	Country (ISO 3166-1)
UP1026	U3415	subsp. *dioica*	LR	0,570	4	1,4	1,8	5	N49.62425	E17.94108	255	CZE
UP1027	U3416	subsp. *dioica*	LR	0,571	4	1,0	1,6	5	N49.64017	E17.95661	253	CZE
UP1028	U3417	subsp. *dioica*	LR	0,566	4	1,5	1,9	5	N49.64036	E17.95769	258	CZE
UP1029	U3418	subsp. *dioica*	TU	0,560	4	1,3	1,7	5	N49.66181	E17.19853	225	CZE
	U3419	subsp. *dioica*	TU	0,565	4	1,3	1,8	5	N49.66181	E17.19853	225	CZE
UP1030	U3420	subsp. *dioica*	LR	0,573	4	1,3	1,5	7	N49.25802	E19.35884	502	SVK
UP1031	U3421	subsp. *dioica*	LR	0,576	4	0,9	1,5	4	N49.26060	E19.66255	869	SVK
UP1032	U3422	subsp. *dioica*	SM	0,565	4	1,5	1,7	5	N49.41103	E19.50434	597	SVK
	U3423	subsp. *dioica*	SM	0,575	4	1,6	1,4	5	N49.41103	E19.50434	597	SVK
UP1033	U3424	subsp. *dioica*	LR	0,588	4	0,8	1,4	3	N48.63086	E14.20893	725	CZE
UP1034	U3425	subsp. *dioica*	FK	0,571	4	1,3	2,0	5	N51.74460	W1.24750	58	GBR
UP1035	U3426	subsp. *dioica*	RB	0,570	4	1,7	1,5	6	N48.97592	E15.48048	504	CZE
UP1036	U3427	subsp. *dioica*	RB	0,570	4	1,2	1,7	5	N48.98448	E15.48140	589	CZE
UP1037	U3428	subsp. *dioica*	RB	0,574	4	1,3	1,7	5	N48.98645	E15.46177	493	CZE
UP1038	U3429	subsp. *dioica*	JC	0,568	4	1,4	2,5	1	N40.92873	E24.08205	1578	GRC
UP1039	U3431	subsp. *dioica*	LR	0,567	4	1,3	1,6	5	N50.38588	E13.10847	439	CZE
UP1040	U3432	subsp. *dioica*	RB	0,573	4	1,0	1,7	5	N49.87694	E14.43689	211	CZE
UP1041	U3433	subsp. *dioica*	FK	0,557	4	1,4	1,5	5	N49.41173	E20.44884	460	POL
UP1042	U3434	subsp. *dioica*	LR	0,572	4	1,5	1,9	4	N49.38320	E20.45695	312	SVK
UP1043	U3435	subsp. *dioica*	LR	0,565	4	1,5	1,8	6	N49.41665	E20.44759	485	POL
UP1044	U3436	subsp. *dioica*	LR	0,562	4	1,4	1,5	8	N49.40072	E20.42767	485	POL
UP1045	U3437	subsp. *dioica*	TU	0,566	4	1,2	1,4	4	N49.41481	E20.41742	903	POL
UP1046	U3438	subsp. *dioica*	RB	0,572	4	1,1	1,8	5	N49.87784	E14.42312	220	CZE
UP1047	U3439	subsp. *dioica*	JC	0,569	4	1,0	1,2	1	N48.54874	E20.42373	247	SVK
	U3440	subsp. *dioica*	JC	0,574	4	0,9	1,2	1	N48.54874	E20.42373	247	SVK
UP1048	U3441	subsp. *dioica*	TU	0,567	4	1,6	1,7	5	N50.63117	E14.71847	271	CZE
	U3442	subsp. *dioica*	TU	0,577	4	1,1	1,7	5	N50.63117	E14.71847	271	CZE
UP1049	U3443	subsp. *dioica*	RB	0,566	4	1,5	2,9	4	N49.74139	E13.40778	315	CZE
UP1050	U3444	subsp. *dioica*	PV, TU	0,547	4	0,9	1,4	3	N52.31524	E13.49545	39	DEU
UP1051	U3445	subsp. *dioica*	FK	0,574	4	1,5	1,5	2	N49.20029	E19.72378	2111	SVK
UP1052	U3446	subsp. *dioica*	VC	0,565	4	1,2	1,8	1	N49.67824	E13.97619	512	CZE
UP1053	U3447	subsp. *dioica*	ML	0,564	4	0,8	1,1	3	N49.36828	E16.71380	330	CZE
UP1054	U3448	subsp. *dioica*	JC	0,576	4	1,2	1,5	1	N48.77653	E20.33808	967	SVK
UP1055	U3449	subsp. *dioica*	HC	0,572	4	0,9	1,1	5	N47.69643	E14.10802	630	AUT
UP1056	U3450	subsp. *dioica*	HC	0,567	4	1,0	1,3	3	N47.70370	E14.08340	1372	AUT
UP1057	U3451	subsp. *dioica*	HC	0,574	4	0,9	1,1	6	N47.69972	E14.08743	1214	AUT
UP1058	U3452	subsp. *subinermis*	FK	0,305	2	1,5	2,3	5	N48.67792	E16.94604	166	CZE
UP1059	U3453	subsp. *dioica*	FK	0,572	4	1,8	1,9	5	N49.42659	E16.36681	355	CZE
UP1060	U3454	subsp. *dioica*	LR	0,560	4	0,8	1,2	7	N49.50856	E13.99431	503	CZE
UP1061	U3455	subsp. *dioica*	FK	0,577	4	1,3	1,5	5	N48.73150	E16.84789	179	CZE
UP1062	U3456	subsp. *dioica*	RB	0,572	4	1,0	1,4	5	N49.51019	E14.65849	518	CZE

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UP1063	U3457	subsp. *dioica*	RB	0,584	4	1,1	1,4	5	N49.88020	E14.25263	563	CZE
UP1064	U3458	subsp. *dioica*	RB	0,580	4	1,0	1,5	5	N49.91337	E14.29908	431	CZE
UP1065	U3459	subsp. *dioica*	RB	0,564	4	0,7	1,4	4	N50.04606	E14.37841	318	CZE
UP1066	U3460	subsp. *dioica*	RB	0,574	4	1,1	1,5	5	N49.96983	E14.12995	252	CZE
UP1067	U3461	subsp. *dioica*	RB	0,570	4	0,7	1,4	5	N49.94670	E14.15664	301	CZE
UP1068	U3462	subsp. *dioica*	RB	0,579	4	1,2	1,4	3	N49.94636	E14.16995	365	CZE
UP1069	U3463	subsp. *dioica*	RB	0,564	4	1,3	1,4	5	N49.94769	E14.18222	308	CZE
UP1070	U3464	subsp. *dioica*	RB	0,556	4	1,4	2,0	5	N50.78383	E15.17549	745	CZE
	U3465	subsp. *dioica*	RB	0,575	4	1,5	1,7	6	N50.78383	E15.17549	745	CZE
UP1071	U3466	subsp. *dioica*	RB	0,573	4	1,0	1,8	5	N49.78898	E13.88350	461	CZE
UP1072	U3467	subsp. *dioica*	JPT	0,572	4	0,8	0,9	6	N50.03202	E13.86680	262	CZE
	U3468	subsp. *dioica*	JPT	0,569	4	0,8	1,3	7	N50.03202	E13.86680	262	CZE
UP1073	U3469	subsp. *dioica*	TU	0,565	4	1,0	1,7	5	N50.17132	E14.37658	173	CZE
UP1074	U3470	subsp. *dioica*	HP	0,560	4	0,8	1,1	7	N50.30864	E15.18272	199	CZE
UP1075	U3471	subsp. *dioica*	TU	0,565	4	1,1	1,3	5	N50.13796	E17.20993	631	CZE
	U3472	subsp. *dioica*	TU	0,563	4	0,8	1,2	5	N50.13796	E17.20993	631	CZE
UP1076	U3473	subsp. *dioica*	TU	0,563	4	1,9	1,4	3	N50.11451	E17.24338	938	CZE
UP1077	U3474	subsp. *dioica*	TU	0,557	4	0,9	1,3	6	N50.08613	E17.28470	1009	CZE
UP1078	U3475	subsp. *dioica*	TU	0,572	4	1,2	1,9	2	N50.94769	E13.70072	402	DEU
UP1079	U3486	subsp. *dioica*	FK	0,575	4	1,7	1,7	1	N48.16494	E24.27932	537	UKR
UP1080	U3488	subsp. *dioica*	LR	0,568	4	1,9	1,7	3	N48.43192	E21.80889	96	SVK
UP1081	U3490	subsp. *dioica*	LR	0,570	4	1,5	2,2	1	N48.47369	E22.10936	101	SVK
UP1082	U3494	subsp. *dioica*	LR	0,568	4	1,1	2,6	2	N48.50175	E22.04572	99	SVK
UP1083	U3496	subsp. *dioica*	LR	0,573	4	1,5	2,5	6	N48.48619	E22.03809	97	SVK
UP1084	U3497	subsp. *dioica*	LR	0,578	4	1,5	2,2	2	N48.48737	E21.87638	97	SVK
UP1085	U3498	subsp. *dioica*	LR	0,571	4	1,4	1,9	6	N48.34578	E21.83408	94	HUN
UP1086	U3500	subsp. *dioica*	TF	0,574	4	1,7	1,4	1	N57.53519	W6.19606	186	GBR
UP1087	U3501	subsp. *dioica*	TU	0,568	4	1,3	1,5	5	N50.73474	E14.58078	297	CZE
UP1088	U3502	subsp. *dioica*	FK	0,573	4	1,0	1,8	5	N52.28069	E14.69829	37	POL
UP1089	U3503	subsp. *dioica*	TU	0,581	4	1,1	1,7	1	N50.30324	E14.47972	165	CZE
UP1090	U3504	subsp. *dioica*	RB	0,565	4	1,3	1,6	5	N48.86092	E16.64485	343	CZE
UP1091	U3505	subsp. *dioica*	VC	0,562	4	1,7	1,3	1	N49.99489	E14.39894	191	CZE
UP1092	U3506	subsp. *subinermis*	LR	0,300	2	1,6	2,8	1	N48.64465	E16.93118	150	CZE
UP1093	U3507	subsp. *subinermis*	LR	0,297	2	1,1	2,5	1	N48.64827	E16.93423	160	CZE
	U3508	subsp. *dioica*	LR	0,573	4	1,2	1,7	1	N48.64827	E16.93423	160	CZE
UP1094	U3509	subsp. *subinermis*	LR	0,300	2	1,3	2,0	1	N48.64750	E16.93443	158	CZE
UP1095	U3510	subsp. *subinermis*	LR	0,301	2	1,5	2,7	1	N48.65507	E16.94273	158	CZE
UP1096	U3511	subsp. *dioica*	LR	0,574	4	1,4	1,7	1	N48.65342	E16.92287	150	CZE
	U3512	subsp. *subinermis*	LR	0,297	2	1,2	2,3	1	N48.65342	E16.92287	150	CZE
UP1097	U3513	subsp. *dioica*	JPR	0,567	4	2,3	1,7	5	N42.27803	W2.96736	1480	ESP
UP1098	U3514	subsp. *dioica*	FK	0,562	4	1,3	1,8	5	N43.63925	E21.89619	330	SRB

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UP1099	U3515	subsp. *dioica*	FK	0,569	4	0,8	1,3	5	N43.16094	E22.13836	542	SRB
UP1100	U3516	subsp. *dioica*	MDU	0,575	4	1,3	1,1	8	N50.31558	E15.49397	244	CZE
	U3517	subsp. *dioica*	MDU	0,574	4	0,7	1,2	9	N50.31558	E15.49397	244	CZE
	U3518	subsp. *dioica*	MDU	0,577	4	0,6	0,9	9	N50.31558	E15.49397	244	CZE
UP1101	U3519	subsp. *dioica*	TU	0,564	4	1,2	1,6	5	N50.59135	E14.63483	270	CZE
UP1102	U3520	subsp. *dioica*	TF	0,564	4	1,5	2,8	5	N49.41424	E21.24733	501	SVK
UP1103	U3521	subsp. *dioica*	FK	0,568	4	1,4	1,9	6	N49.82975	E14.44353	242	CZE
UP1104	U3522	subsp. *dioica*	FK	0,578	4	0,9	1,2	1	N48.96031	E20.38328	597	SVK
UP1105	U3523	subsp. *dioica*	GF	0,566	4	1,3	1,6	1	N48.90635	E14.88913	466	CZE
UP1106	U3524	subsp. *dioica*	PK	0,575	4	1,2	1,6	5	N50.38917	E13.98833	180	CZE
	U3525	subsp. *dioica*	PK	0,575	4	1,2	2,0	5	N50.38917	E13.98833	180	CZE
	U3526	subsp. *dioica*	PK	0,578	4	1,6	1,7	5	N50.38917	E13.98833	180	CZE
	U3527	subsp. *dioica*	PK	0,579	4	1,4	1,5	5	N50.38917	E13.98833	180	CZE
UP1107	U3528	subsp. *dioica*	LR	0,564	4	0,7	0,9	4	N48.65237	E14.45241	631	CZE
UP1108	U3529	subsp. *dioica*	FK	0,568	4	1,3	1,5	5	N47.60378	E18.41935	410	HUN
UP1109	U3530	subsp. *dioica*	FK	0,573	4	0,8	1,3	1	N49.25778	E19.70078	1068	SVK
UP1110	U3531	subsp. *dioica*	LR	0,568	4	1,2	1,3	3	N49.29034	E19.07965	633	SVK
UP1111	U3532	subsp. *dioica*	TU	0,581	4	1,6	1,7	5	N50.12241	E14.39781	176	CZE
UP1112	U3533	subsp. *dioica*	TU	0,569	4	1,3	1,9	1	N50.71397	W1.74882	15	GBR
UP1113	U3534	subsp. *dioica*	TU	0,549	4	1,1	1,3	1	N50.32944	E13.08614	500	CZE
UP1114	U3537	subsp. *dioica*	LR	0,562	4	0,9	1,7	8	N50.30595	E16.40378	1090	CZE
UP1115	U3538	subsp. *dioica*	LR	0,573	4	1,2	1,4	6	N50.30282	E16.40007	1105	CZE
UP1116	U3539	subsp. *dioica*	LR	0,566	4	1,0	1,3	3	N50.19017	E16.42113	570	CZE
UP1117	U3540	subsp. *dioica*	LR	0,568	4	1,5	1,6	5	N50.15467	E16.81568	734	CZE
UP1118	U3541	subsp. *dioica*	TU	0,565	4	1,7	1,4	5	N50.51662	E15.23110	441	CZE
UP1119	U3542	subsp. *subinermis*	TU	0,301	2	1,5	1,9	5	N48.75494	E17.01278	162	CZE
	U3741	subsp. *subinermis*	TU	0,308	2	0,7	1,7	1	N48.75494	E17.01278	180	CZE
	U3742	subsp. *subinermis*	TU	0,311	2	1,0	2,0	1	N48.75494	E17.01278	180	CZE
	U3743	subsp. *subinermis*	TU	0,300	2	0,9	1,9	1	N48.75494	E17.01278	180	CZE
	U3744	subsp. *subinermis*	TU	0,304	2	0,9	1,8	1	N48.75494	E17.01278	180	CZE
	U3745	subsp. *subinermis*	TU	0,306	2	0,8	2,3	1	N48.75494	E17.01278	180	CZE
	U3746	subsp. *subinermis*	TU	0,301	2	1,0	2,0	1	N48.75494	E17.01278	180	CZE
	U3747	subsp. *subinermis*	TU	0,299	2	1,1	3,1	1	N48.75494	E17.01278	180	CZE
	U3748	subsp. *subinermis*	TU	0,302	2	0,8	1,9	1	N48.75494	E17.01278	180	CZE
UP1120	U3543	subsp. *dioica*	LR	0,562	4	1,6	1,9	5	N49.17228	E17.49214	305	CZE
UP1121	U3544	subsp. *dioica*	LR	0,547	4	1,2	1,8	5	N49.22339	E17.49944	189	CZE
UP1122	U3545	subsp. *dioica*	LR	0,549	4	1,3	2,4	5	N49.37406	E17.68289	495	CZE
UP1123	U3546	subsp. *dioica*	LR	0,553	4	1,5	1,6	5	N49.46386	E17.47283	219	CZE
UP1124	U3547	subsp. *dioica*	LR	0,559	4	0,9	1,9	5	N49.46364	E17.47928	210	CZE
UP1125	U3548	subsp. *dioica*	LR	0,539	4	1,4	1,8	5	N49.52522	E17.32967	235	CZE
UP1126	U3549	subsp. *dioica*	LR	0,544	4	1,5	1,8	5	N49.65614	E17.21794	221	CZE

ID number of population	ID number of analysis	Taxon	Collector	Relative fluorescence intensity	DNA-ploidy level	CV of standard	CV of sample	N. of individuals in analysis	Latitude (WGS-84)	Longitude (WGS-84)	Altitude (m a.s.l.)	Country (ISO 3166-1)
UP1127	U3550	subsp. *dioica*	LR	0,536	4	1,3	2,0	5	N49.71458	E17.02497	249	CZE
UP1128	U3551	subsp. *dioica*	LR	0,565	4	1,5	1,6	1	N49.87303	E14.86442	394	CZE
UP1129	U3552	subsp. *dioica*	LR	0,563	4	1,6	1,9	1	N49.87133	E14.86717	422	CZE
UP1130	U3553	subsp. *subinermis*	LR	0,294	2	1,2	2,3	1	N48.81786	E16.79511	165	CZE
	U3554	subsp. *subinermis*	LR	0,290	2	1,4	2,2	1	N48.81786	E16.79511	165	CZE
	U3583	subsp. *subinermis*	LR	0,293	2	1,7	2,3	1	N48.81786	E16.79511	165	CZE
	U3584	subsp. *subinermis*	LR	0,292	2	1,8	2,2	1	N48.81786	E16.79511	165	CZE
	U3585	subsp. *subinermis*	LR	0,294	2	1,4	1,8	1	N48.81786	E16.79511	165	CZE
	U3587	subsp. *subinermis*	LR	0,297	2	1,1	2,0	1	N48.81786	E16.79511	165	CZE
	U3589	subsp. *subinermis*	LR	0,299	2	1,7	2,2	1	N48.81786	E16.79511	165	CZE
UP1131	U3560	subsp. *dioica*	LR	0,552	4	0,8	1,3	5	N48.84814	E16.72608	172	CZE
UP1132	U3562	subsp. *dioica*	LR	0,537	4	1,2	1,7	5	N48.86386	E17.10486	176	CZE
UP1133	U3563	subsp. *dioica*	PT	0,574	4	1,5	1,5	1	N49.80392	E12.63092	547	CZE
	U3564	subsp. *dioica*	PT	0,583	4	1,0	1,5	1	N49.80392	E12.63092	547	CZE
	U3565	subsp. *dioica*	PT	0,580	4	0,9	1,7	1	N49.80392	E12.63092	547	CZE
	U3566	subsp. *dioica*	PT	0,583	4	1,0	1,5	1	N49.80392	E12.63092	547	CZE
UP1134	U3567	subsp. *dioica*	RB	0,570	4	1,2	1,6	3	N49.86995	E14.45417	239	CZE
UP1135	U3568	subsp. *dioica*	AK	0,562	4	1,0	1,4	1	N50.05727	E17.23674	1308	CZE
UP1136	U3569	subsp. *dioica*	FK	0,566	4	1,5	2,1	5	N49.57099	E15.93968	566	CZE
UP1137	U3572	subsp. *subinermis*	LR	0,247	2	1,4	2,3	1	N48.69164	E16.99350	160	CZE
	U3573	subsp. *subinermis*	LR	0,245	2	1,3	1,8	1	N48.69164	E16.99350	160	CZE
	U3574	subsp. *subinermis*	LR	0,294	2	1,6	2,1	1	N48.69164	E16.99350	160	CZE
	U3575	subsp. *subinermis*	LR	0,302	2	1,4	2,1	1	N48.69164	E16.99350	160	CZE
	U3576	subsp. *subinermis*	LR	0,305	2	2,2	2,3	1	N48.69164	E16.99350	160	CZE
	U3577	subsp. *subinermis*	LR	0,293	2	1,9	2,0	1	N48.69164	E16.99350	160	CZE
UP1138	U3578	subsp. *dioica*	LR	0,548	4	1,2	1,5	5	N49.71961	E17.03003	245	CZE
UP1139	U3579	subsp. *subinermis*	LR	0,293	2	1,8	1,6	1	N48.69203	E16.99444	169	CZE
	U3580	subsp. *subinermis*	LR	0,295	2	1,7	2,3	1	N48.69203	E16.99444	169	CZE
	U3581	subsp. *subinermis*	LR	0,295	2	1,9	1,9	1	N48.69203	E16.99444	169	CZE
	U3582	subsp. *subinermis*	LR	0,300	2	2,8	2,0	1	N48.69203	E16.99444	169	CZE
	U3699	subsp. *subinermis*	TU	0,296	2	1,0	2,2	1	N48.69203	E16.99444	155	CZE
	U3700	subsp. *subinermis*	TU	0,299	2	1,3	1,8	1	N48.69203	E16.99444	155	CZE
	U3701	subsp. *subinermis*	TU	0,303	2	1,4	2,2	1	N48.69203	E16.99444	155	CZE
	U3702	subsp. *subinermis*	TU	0,304	2	0,8	2,3	1	N48.69203	E16.99444	155	CZE
	U3703	subsp. *subinermis*	TU	0,301	2	0,8	1,7	1	N48.69203	E16.99444	155	CZE
	U3704	subsp. *subinermis*	TU	0,296	2	0,9	2,1	1	N48.69203	E16.99444	155	CZE
	U3705	subsp. *subinermis*	TU	0,300	2	2,6	1,2	1	N48.69203	E16.99444	155	CZE
	U3706	subsp. *subinermis*	TU	0,296	2	1,4	1,9	1	N48.69203	E16.99444	155	CZE
	U3707	subsp. *subinermis*	TU	0,291	2	0,7	1,9	1	N48.69203	E16.99444	155	CZE
	U3708	subsp. *subinermis*	TU	0,295	2	0,9	1,4	1	N48.69203	E16.99444	155	CZE
	U3709	subsp. *subinermis*	TU	0,297	2	0,9	1,9	1	N48.69203	E16.99444	155	CZE

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	U3710	subsp. *subinermis*	TU	0,297	2	0,8	2,3	1	N48.69203	E16.99444	155	CZE
	U3711	subsp. *subinermis*	TU	0,304	2	1,1	2,3	1	N48.69203	E16.99444	155	CZE
	U3712	subsp. *subinermis*	TU	0,298	2	0,9	1,8	1	N48.69203	E16.99444	155	CZE
	U3713	subsp. *subinermis*	TU	0,300	2	0,9	1,8	1	N48.69203	E16.99444	155	CZE
	U3714	subsp. *subinermis*	TU	0,298	2	1,0	2,2	1	N48.69203	E16.99444	155	CZE
	U3715	subsp. *subinermis*	TU	0,295	2	0,9	2,2	1	N48.69203	E16.99444	155	CZE
	U3716	subsp. *subinermis*	TU	0,295	2	0,9	2,2	1	N48.69203	E16.99444	155	CZE
	U3717	subsp. *subinermis*	TU	0,295	2	0,7	2,3	1	N48.69203	E16.99444	155	CZE
	U3718	subsp. *subinermis*	TU	0,310	2	0,7	1,8	1	N48.69203	E16.99444	155	CZE
	U3719	subsp. *subinermis*	TU	0,296	2	0,9	2,0	1	N48.69203	E16.99444	155	CZE
	U3720	subsp. *subinermis*	TU	0,294	2	0,8	2,1	1	N48.69203	E16.99444	155	CZE
	U3721	subsp. *subinermis*	TU	0,302	2	0,7	1,7	1	N48.69203	E16.99444	155	CZE
	U3722	subsp. *subinermis*	TU	0,302	2	0,7	1,9	1	N48.69203	E16.99444	155	CZE
	U3723	subsp. *subinermis*	TU	0,294	2	1,1	1,8	1	N48.69203	E16.99444	155	CZE
UP1140	U3586	subsp. *dioica*	LR	0,559	4	1,4	1,4	1	N48.76867	E20.08392	663	SVK
UP1141	U3588	subsp. *dioica*	LR	0,559	4	1,6	1,6	1	N48.70996	E19.97911	684	SVK
UP1142	U3590	subsp. *subinermis*	LR	0,292	2	1,8	2,1	1	N48.84436	E16.72625	174	CZE
	U3591	subsp. *subinermis*	LR	0,290	2	1,1	2,6	1	N48.84436	E16.72625	174	CZE
	U3592	subsp. *subinermis*	LR	0,295	2	1,3	2,4	1	N48.84436	E16.72625	174	CZE
UP1143	U3598	subsp. *dioica*	HP	0,574	4	1,5	1,9	5	N46.49161	E23.36917	1116	ROU
UP1144	U3599	subsp. *dioica*	TU	0,569	4	1,0	1,4	5	N47.19958	E12.60794	1104	AUT
UP1145	U3600	subsp. *dioica*	TU	0,566	4	1,4	1,8	5	N47.25683	E12.56569	816	AUT
UP1146	U3601	subsp. *dioica*	TF	0,578	4	1,3	1,5	1	N60.34993	E6.06243	383	NOR
UP1147	U3602	subsp. *dioica*	TF	0,566	4	1,3	1,5	5	N48.08440	E19.29908	141	SVK
UP1148	U3603	subsp. *dioica*	TF	0,573	4	1,3	1,5	5	N48.22987	E20.03014	217	SVK
UP1149	U3604	subsp. *dioica*	TF	0,573	4	1,0	1,9	5	N48.15012	E18.22183	125	SVK
UP1150	U3605	subsp. *dioica*	HP	0,566	4	1,2	1,5	5	N44.92503	E5.32158	1231	FRA
UP1151	U3606	subsp. *dioica*	HP	0,575	4	1,1	1,7	5	N46.98603	E4.65158	464	FRA
UP1152	U3607	subsp. *dioica*	TF	0,569	4	1,3	1,5	5	N49.00777	E18.99454	538	SVK
UP1153	U3608	subsp. *dioica*	TU	0,571	4	0,7	1,6	5	N50.26283	E13.67439	468	CZE
UP1154	U3609	subsp. *dioica*	TF	0,566	4	1,5	1,3	1	N58.68263	E8.89998	160	NOR
UP1155	U3610	subsp. *dioica*	TU	0,562	4	1,3	2,0	5	N48.79511	E16.84546	177	CZE
UP1156	U3611	subsp. *dioica*	TF	0,557	4	1,4	1,8	5	N48.52903	E18.65988	347	SVK
UP1157	U3612	subsp. *dioica*	TU	0,567	4	1,9	2,6	5	N48.80234	E16.83860	160	CZE
UP1158	U3613	subsp. *dioica*	TF	0,583	4	1,3	1,9	5	N48.19424	E19.53029	165	SVK
UP1159	U3614	subsp. *dioica*	TF	0,566	4	1,1	1,9	5	N48.18147	E20.02580	275	SVK
UP1160	U3615	subsp. *dioica*	TF	0,583	4	1,1	2,5	1	N61.08068	E6.68336	1533	NOR
UP1161	U3616	subsp. *dioica*	TF	0,568	4	0,9	1,4	5	N48.12791	E19.81045	278	HUN
UP1162	U3617	subsp. *dioica*	TF	0,559	4	1,4	1,6	5	N52.29428	E13.67026	37	DEU
UP1163	U3618	subsp. *dioica*	TF	0,560	4	1,1	1,3	5	N48.16767	E19.85739	434	SVK
UP1164	U3619	subsp. *dioica*	FK	0,561	4	1,2	1,5	5	N49.36692	E14.51387	376	CZE

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UP1165	U3620	subsp. *dioica*	TF	0,565	4	1,2	1,7	1	N61.05617	E6.53475	265	NOR
UP1166	U3621	subsp. *dioica*	FK	0,565	4	0,9	1,3	5	N51.71787	E10.96383	285	DEU
UP1167	U3622	subsp. *dioica*	TU	0,560	4	1,3	1,7	5	N48.80024	E16.83799	163	CZE
UP1168	U3623	subsp. *dioica*	FK	0,573	4	1,1	1,8	5	N41.02797	E20.13103	408	ALB
UP1169	U3624	subsp. *dioica*	FK	0,560	4	0,6	0,9	5	N50.01969	E13.99410	310	CZE
UP1170	U3625	subsp. *dioica*	FK	0,568	4	0,9	1,6	5	N50.28292	E14.51444	168	CZE
UP1171	U3626	subsp. *subinermis*	GF	0,311	2	1,2	2,0	5	N46.27935	E13.83443	527	SVN
UP1172	U3627	subsp. *dioica*	GF	0,576	4	1,0	1,3	5	N44.52922	E15.18808	946	HRV
UP1173	U3631	subsp. *dioica*	LR	0,556	4	1,2	2,2	3	N48.83785	E16.07926	207	CZE
UP1174	U3632	subsp. *dioica*	LR	0,570	4	1,3	1,9	2	N48.82202	E16.09208	250	CZE
UP1175	U3633	subsp. *dioica*	LR	0,580	4	1,5	2,6	3	N50.33100	E15.14342	265	CZE
UP1176	U3634	subsp. *dioica*	LR	0,570	4	1,1	1,6	2	N50.32974	E15.14127	261	CZE
UP1177	U3635	subsp. *dioica*	LR	0,568	4	1,4	1,9	3	N50.34716	E15.12031	254	CZE
UP1178	U3636	subsp. *dioica*	TU	0,564	4	1,2	1,7	5	N47.16406	E12.61414	1847	AUT
UP1179	U3637	subsp. *dioica*	LR	0,593	4	1,6	2,4	2	N48.80670	E16.64669	364	CZE
UP1180	U3639	subsp. *dioica*	HP	0,564	4	1,5	1,9	5	N45.44117	E5.91872	1522	FRA
UP1181	U3640	subsp. *dioica*	HP	0,563	4	1,3	1,6	5	N46.69050	E5.63856	397	FRA
UP1182	U3641	subsp. *dioica*	JR	0,562	4	0,8	1,8	3	N49.17515	E16.22023	367	CZE
UP1183	U3642	subsp. *dioica*	JR	0,571	4	1,2	1,7	3	N49.14487	E16.24577	294	CZE
UP1184	U3643	subsp. *dioica*	JR	0,564	4	0,9	1,2	4	N49.17501	E16.16400	369	CZE
UP1185	U3644	subsp. *dioica*	JR	0,573	4	0,7	1,1	1	N49.16998	E16.16611	339	CZE
UP1186	U3645	subsp. *dioica*	JR	0,562	4	0,6	0,9	1	N49.16796	E16.17160	335	CZE
UP1187	U3646	subsp. *dioica*	JR	0,558	4	0,7	1,7	1	N49.15542	E16.16894	310	CZE
UP1188	U3647	subsp. *dioica*	FK	0,570	4	0,9	1,6	5	N46.56625	E23.67342	504	ROU
UP1189	U3648	subsp. *dioica*	LR	0,567	4	1,0	1,5	4	N49.17654	E14.30722	429	CZE
UP1190	U3649	subsp. *dioica*	LR	0,558	4	0,9	1,3	5	N49.17473	E14.30588	430	CZE
UP1191	U3650	subsp. *dioica*	LR	0,571	4	1,5	1,7	6	N49.17421	E14.30265	429	CZE
	U3651	subsp. *dioica*	LR	0,563	4	1,0	1,4	3	N49.17421	E14.30265	429	CZE
UP1192	U3652	subsp. *dioica*	TF	0,570	4	1,1	1,5	5	N49.10220	E19.24182	461	SVK
UP1193	U3653	subsp. *dioica*	TF	0,569	4	1,9	1,4	5	N48.91019	E19.09019	1478	SVK
UP1194	U3654	subsp. *dioica*	FK	0,571	4	0,9	1,1	1	N60.04506	E6.46348	482	NOR
UP1195	U3655	subsp. *dioica*	FK	0,573	4	1,2	2,2	4	N50.02938	E14.56324	256	CZE
UP1196	U3657	subsp. *dioica*	LM	0,565	4	0,7	1,9	3	N48.88197	E19.09267	1178	SVK
UP1197	U3658	subsp. *dioica*	TU	0,576	4	0,8	1,6	5	N48.20125	E17.83014	118	SVK
UP1198	U3659	subsp. *dioica*	TU	0,576	4	1,6	1,3	5	N48.20592	E17.83425	119	SVK
UP1199	U3660	subsp. *dioica*	AK	0,555	4	1,4	1,6	5	N50.74931	E15.54836	1334	CZE
UP1200	U3661	subsp. *subinermis*	TU	0,300	2	1,1	2,3	5	N48.52083	E16.94933	148	SVK
UP1201	U3662	subsp. *dioica*	TU	0,583	4	1,8	2,2	5	N48.77911	E16.79110	182	CZE
UP1202	U3663	subsp. *dioica*	LR	0,571	4	1,7	1,7	5	N49.32120	E14.70193	397	CZE
UP1203	U3664	subsp. *dioica*	LR	0,564	4	1,3	1,6	5	N49.28469	E14.69965	399	CZE
UP1204	U3665	subsp. *dioica*	LR	0,564	4	1,1	1,8	5	N49.23439	E14.71557	403	CZE

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UP1205	U3666	subsp. *dioica*	LR	0,569	4	1,1	1,5	5	N49.20391	E14.70973	408	CZE
UP1206	U3667	subsp. *dioica*	LR	0,567	4	1,3	1,7	5	N49.12221	E14.73877	422	CZE
UP1207	U3668	subsp. *dioica*	LR	0,577	4	1,2	1,8	5	N49.04412	E14.80038	425	CZE
UP1208	U3669	subsp. *dioica*	RB	0,574	4	1,0	1,3	5	N49.19341	E14.71564	412	CZE
UP1209	U3670	subsp. *dioica*	FK	0,571	4	1,1	1,7	1	N51.80278	E10.30406	484	DEU
UP1210	U3671	subsp. *dioica*	RB	0,570	4	1,3	1,7	3	N50.56705	E13.97290	666	CZE
UP1211	U3672	subsp. *dioica*	FK	0,581	4	1,6	1,4	1	N50.06512	E14.44752	204	CZE
UP1212	U3674	subsp. *dioica* triploid	LR	0,426	3	1,2	1,7	1	N50.17098	E14.86100	190	CZE
UP1213	U3675	subsp. *dioica*	LR	0,563	4	1,7	2,2	1	N50.17027	E14.85982	190	CZE
UP1214	U3676	subsp. *dioica*	TF	0,566	4	1,5	2,4	5	N48.47768	E17.43095	238	SVK
UP1215	U3678	subsp. *dioica*	RB	0,568	4	0,9	1,6	5	N47.33304	E13.29504	842	AUT
UP1216	U3679	subsp. *dioica*	RB	0,570	4	1,1	1,6	5	N56.14470	E10.17401	4	DNK
UP1217	U3680	subsp. *dioica*	RB	0,559	4	0,9	1,7	4	N56.17545	E10.22845	15	DNK
UP1218	U3681	subsp. *dioica*	TU	0,578	4	1,2	2,5	1	N46.23859	E13.81246	1880	SVN
UP1231	U3843	subsp. *dioica*	TU	0,563	4	1,5	2,9	1	N56.60083	E61.05650	207	RUS

Collectors: AK – Adam Knotek, AR – Adéla Rejlová, BS – Bohuna Senius, CP – Clemens Pachschwöll, DH – Dana Hubková, DR – Danijela Rostohar, EZ – Eliška Záveská, FK – Filip Kolář, GF – Gábina Fuxová, HC – Hana Chudáčková, HD – Hana Daneck, HJ – Hana Jirsáková, HP – Hana Přívozníková, IR – Iva Riegerová, JA – Jana Aichlerová, JB – Jana Bajerová, JC – Jindřich Chrtek, JH – Johana Hanzlíčková, JP – Jan Ponert, JPR – Jan Prančl, JPT – Jan Ptáček, JR – Jan Rydlo, JS – Jan Smyčka, JV – Jana Vítová, KH – Kristýna Hanušová, KK – Klára Kabátová, KS – Kristýna Šemberová, KSE – Kari Senius, KSR – Kamila Šrédlová, LM – Lenka Macková, LR – Ludmila Rejlová, MD – Martin Dudáš, MDU – Michal Ducháček, ML – Magdalena Lučanová, OK – Ondřej Kouklík, PK – Pavel Kúr, PT – Pavel Trávníček, PV – Petr Vít, RB – Romana Bartošová, SM – Štefan Murín, SP – Soňa Píšová, SS – Šárka Svobodová, TF – Tomáš Figura, TR – Tamara Rejlová, TU – Tomáš Urfus, VC – Václav Černohorský, VK – Veronika Konečná, VR – Vojtěch Rejl, ZC – Zuzana Chumová, ZK – Zdeněk Kaplan.

Table S2. List of analysis (absolute genome size) of *Urtica dioica* (sorted by recognized taxa and identification number of population). For each population the information is provided about geography coordinates in WGS-84 system, altitude and abbreviation of country, collectors initials, absolute genome size – 2C-value (pg), ploidy level, coefficient of variance of standard and samples.

ID number of population	ID number of analysis	Taxon	Collector	2C-value (pg)	Ploidy level	CV of standard	CV of sample	Latitude (WGS-84)	Longitude (WGS-84)	Altitude (m a.s.l.)	Country (ISO 3166-1)
UP1219	U3831	subsp. *cypria*	PT, ZC	1,66	3	1,2	1,8	N34.93594	E33.02818	1077	CYP
	U3832	subsp. *cypria*	PT, ZC	1,67	3	1,3	1,9	N34.93594	E33.02818	1077	CYP
	U3833	subsp. *cypria*	PT, ZC	1,66	3	1,2	1,7	N34.93594	E33.02818	1077	CYP
	U3834	subsp. *cypria*	PT, ZC	1,67	3	1,3	2,0	N34.93594	E33.02818	1077	CYP
	U3835	subsp. *cypria*	PT, ZC	1,67	3	1,3	1,8	N34.93594	E33.02818	1077	CYP
	U3836	subsp. *cypria*	PT, ZC	1,67	3	1,3	1,7	N34.93594	E33.02818	1077	CYP
UP0113	U3777	subsp. *dioica*	EZ, FK	2,17	4	1,3	1,7	N54.28356	E16.13995	2	POL
UP0201	U3765	subsp. *dioica*	PT, ZC	2,18	4	1,3	1,7	N37.85794	E13.38822	1130	ITA
UP0202	U3767	subsp. *dioica*	PT, ZC	2,10	4	1,2	2,1	N37.91019	E13.99032	860	ITA
UP0435	U3778	subsp. *dioica*	EZ, FK	2,20	4	2,0	2,5	N69.65605	E18.93484	100	NOR
UP0621	U3772	subsp. *dioica*	PV, TU	2,19	4	1,3	1,6	N51.10167	E17.07150	132	POL
UP0626	U3773	subsp. *dioica*	PV, TU	2,15	4	1,0	1,4	N52.48602	E12.83499	29	DEU
UP0629	U3755	subsp. *dioica*	FK	2,18	4	1,7	2,0	N36.66113	E51.32025	190	IRN
UP0630	U3750	subsp. *dioica*	LR	2,19	4	1,3	1,4	N47.62380	E12.97902	615	DEU
UP0654	U3787	subsp. *dioica*	LR	2,21	4	1,2	1,8	N46.23650	E10.22507	530	ITA
UP0664	U3749	subsp. *dioica*	LR	2,22	4	1,2	1,9	N45.81215	E6.96012	1266	ITA
UP0685	U3751	subsp. *dioica*	LR	2,20	4	1,2	1,8	N45.93151	E6.91746	1916	FRA
UP0725	U3752	subsp. *dioica*	RB, TU	2,27	4	1,5	1,8	N41.19679	E22.77564	146	GRC
UP1220	U3753	subsp. *dioica*	JC, TU	2,13	4	1,5	1,8	N40.70466	E40.65491	1492	TUR
UP1222	U3776	subsp. *dioica*	HC	2,17	4	2,2	2,2	N45.72544	E10.84376	2168	ITA
UP1224	U3770	subsp. *dioica*	FK	2,09	4	1,2	1,4	N47.60377	E18.41934	410	HUN

ID number of population	ID number of analysis	Taxon	Collector	2C-value (pg)	Ploidy level	CV of standard	CV of sample	Latitude (WGS-84)	Longitude (WGS-84)	Altitude (m a.s.l.)	Country (ISO 3166-1)
UP1227	U3764	subsp. *dioica*	FK	2,21	4	1,8	2,9	N48.75449	E16.89148	157	CZE
UP1228	U3771	subsp. *dioica*	PV, TU	2,19	4	1,2	1,4	N51.57042	E13.92891	125	DEU
UP1230	U3763	subsp. *dioica*	LR, SH	2,17	4	1,1	2,0	N55.67540	E13.33463	66	SWE
UP1231	U3754	subsp. *dioica*	TU	2,14	4	1,4	1,9	N56.60083	E61.05650	207	RUS
UP1233	U3762	subsp. *dioica*	LR, SH	2,13	4	1,5	1,4	N59.02181	E14.59265	106	SWE
UP1234	U3756	subsp. *dioica*	LR, SH	2,22	4	1,4	2,0	N59.38068	E27.5539	1	EST
UP1235	U3757	subsp. *dioica*	LR, SH	2,23	4	1,3	1,8	N60.23938	E24.65983	19	FIN
UP1241	U3758	subsp. *dioica*	LR, SH	2,18	4	1,2	1,8	N62.97150	E21.4927	4	FIN
UP1242	U3761	subsp. *dioica*	LR, SH	2,25	4	1,2	1,9	N65.37790	E21.29759	24	SWE
UP1243	U3760	subsp. *dioica*	LR, SH	2,17	4	1,7	2,1	N65.88580	E22.95945	55	SWE
UP1244	U3759	subsp. *dioica*	LR, SH	2,25	4	1,3	1,6	N68.43923	E22.46148	313	SWE
UP1246	U3779	subsp. *dioica*	EZ, FK	2,19	4	1,4	1,8	N69.54531	E19.01271	79	NOR
UP1249	U3775	subsp. *dioica*	PT	2,22	4	1,4	1,9	N55.67545	E12.52854	62	DNK
	U3766	subsp. *dioica*	PT, ZC	2,17	4	1,0	2,1	N37.85794	E13.38822	1130	ITA
	U3768	subsp. *dioica*	PT, ZC	2,17	4	1,2	2,3	N37.91019	E13.99032	860	ITA
	U3769	subsp. *dioica*	PT, ZC	2,14	4	1,2	2,0	N37.91019	E13.99032	860	ITA
	U3774	subsp. *dioica*	FK	2,16	4	1,6	2,2	N36.66114	E51.32025	190	IRN
UP0525	U3784	subsp. *kurdistanica*	JC, TU	1,20	2	1,4	2,7	N38.52032	E35.52553	2196	TUR
UP0527	U3780	subsp. *kurdistanica*	JC, TU	1,18	2	1,3	2,5	N37.35832	E34.69034	1765	TUR
	U3785	subsp. *kurdistanica*	JC, TU	1,16	2	1,7	2,8	N38.52032	E35.52553	2196	TUR
	U3781	subsp. *kurdistanica*	JC, TU	1,19	2	1,3	2,4	N37.35832	E34.69034	1765	TUR
	U3782	subsp. *kurdistanica*	JC, TU	1,19	2	1,2	2,7	N37.35832	E34.69034	1765	TUR
	U3783	subsp. *kurdistanica*	JC, TU	1,16	2	1,4	3,0	N37.35832	E34.69034	1765	TUR
UP0006	U3801	subsp. *pubescens*	PT, TU	1,10	2	1,0	2,0	N46.56411	E11.51614	433	ITA
UP0014	U3802	subsp. *pubescens*	PT, TU	1,10	2	1,0	1,8	N44.76683	E11.85939	1	ITA

ID number of population	ID number of analysis	Taxon	Collector	2C-value (pg)	Ploidy level	CV of standard	CV of sample	Latitude (WGS-84)	Longitude (WGS-84)	Altitude (m a.s.l.)	Country (ISO 3166-1)
UP0656	U3799	subsp. *pubescens*	LR	1,18	2	1,4	3,2	N45.86217	E9.42163	444	ITA
UP0657	U3798	subsp. *pubescens*	LR	1,19	2	1,3	2,8	N45.80548	E9.25597	265	ITA
UP0669	U3797	subsp. *pubescens*	LR	1,21	2	1,3	2,5	N44.37202	E8.07663	465	ITA
UP0673	U3796	subsp. *pubescens*	LR	1,17	2	1,3	2,3	N44.73902	E8.51898	122	ITA
UP0674	U3786	subsp. *pubescens*	LR	1,17	2	1,5	3,0	N45.04970	E8.62982	86	ITA
UP0678	U3794	subsp. *pubescens*	LR	1,15	2	1,4	2,9	N44.88212	E9.61557	342	ITA
UP0679	U3792	subsp. *pubescens*	LR	1,18	2	1,3	2,2	N44.66752	E9.61743	758	ITA
UP0682	U3790	subsp. *pubescens*	LR	1,16	2	1,3	2,5	N44.93050	E10.36508	42	ITA
UP0683	U3789	subsp. *pubescens*	LR	1,21	2	1,2	2,7	N44.90670	E10.51723	14	ITA
UP0684	U3788	subsp. *pubescens*	LR	1,17	2	1,3	2,7	N45.06637	E10.84375	10	ITA
UP1221	U3791	subsp. *pubescens*	LR	1,15	2	1,1	2,8	N44.66751	E9.61743	758	ITA
	U3800	subsp. *pubescens*	LR	1,17	2	1,2	2,5	N45.86217	E9.42163	444	ITA
	U3795	subsp. *pubescens*	LR	1,16	2	1,4	2,4	N45.04970	E8.62982	86	ITA
	U3793	subsp. *pubescens*	LR	1,16	2	1,3	2,7	N44.66752	E9.61743	758	ITA
UP0436	U3804	subsp. *sondenii*	LR, SH	1,15	2	1,7	3,2	N69.67887	E18.89820	1	NOR
UP1245	U3803	subsp. *sondenii*	LR, SH	1,14	2	1,4	2,1	N68.48526	E22.29748	328	FIN
	U3805	subsp. *sondenii*	LR, SH	1,16	2	1,7	3,0	N69.67887	E18.89820	1	NOR
	U3806	subsp. *sondenii*	LR, SH	1,12	2	1,5	2,9	N69.54531	E19.01271	79	NOR
UP0528	U3808	subsp. *subinermis*	TU	1,25	2	1,5	2,7	N37.51418	E34.62849	1208	TUR
UP0529	U3807	subsp. *subinermis*	TU	1,19	2	1,5	2,5	N38.71923	E37.35649	1250	TUR
UP0772	U3815	subsp. *subinermis*	RB, TU	1,12	2	1,0	2,1	N42.80928	E9.48922	7	FRA
UP1223	U3819	subsp. *subinermis*	FK	1,12	2	1,4	2,2	N46.19805	E18.85194	96	HUN
UP1225	U3818	subsp. *subinermis*	FK	1,14	2	1,1	2,4	N48.67931	E16.94617	13	CZE
UP1226	U3817	subsp. *subinermis*	FK	1,10	2	1,1	2,4	N48.69702	E16.95968	154	CZE
UP1232	U3814	subsp. *subinermis*	LR, SH	1,16	2	1,4	2,3	N56.95191	E23.51314	2	LVA

ID number of population	ID number of analysis	Taxon	Collector	2C-value (pg)	Ploidy level	CV of standard	CV of sample	Latitude (WGS-84)	Longitude (WGS-84)	Altitude (m a.s.l.)	Country (ISO 3166-1)
UP1236	U3811	subsp. *subinermis*	LR, SH	1,15	2	1,2	2,4	N61.48451	E29.48244	88	FIN
UP1237	U3812	subsp. *subinermis*	LR, SH	1,18	2	1,5	2,6	N61.84828	E29.17859	129	FIN
UP1238	U3810	subsp. *subinermis*	LR, SH	1,13	2	1,4	2,2	N62.06351	E27.56121	127	FIN
UP1239	U3813	subsp. *subinermis*	LR, SH	1,14	2	1,3	2,2	N62.16090	E28.15618	91	FIN
UP1240	U3809	subsp. *subinermis*	LR, SH	1,16	2	1,3	2,5	N62.90926	E24.82408	150	FIN
	U3816	subsp. *subinermis*	RB, TU	1,11	2	1,2	2,1	N42.80928	E9.48922	7	FRA
	U3820	subsp. *subinermis*	FK	1,15	2	1,1	2,3	N46.19805	E18.85194	96	HUN
	U3821	subsp. *subinermis*	FK	1,17	2	1,5	2,4	N46.19805	E18.85194	96	HUN
	U3822	subsp. *subinermis*	FK	1,14	2	1,8	2,9	N46.19805	E18.85194	96	HUN
	U3823	subsp. *subinermis*	FK	1,14	2	1,1	2,4	N46.19805	E18.85194	96	HUN
	U3824	subsp. *subinermis*	FK	1,16	2	1,1	2,4	N46.19805	E18.85194	96	HUN
	U3825	subsp. *subinermis*	FK	1,14	2	1,0	2,3	N46.19805	E18.85194	96	HUN
UP0774	U3826	*U. atrovirens*	RB, TU	1,19	2	1,2	2,3	N42.30477	E9.15027	460	FRA
UP0776	U3828	*U. atrovirens*	RB, TU	1,18	2	1,4	2,2	N42.37303	E9.14494	440	FRA
UP0777	U3829	*U. atrovirens*	RB, TU	1,19	2	1,1	2,3	N42.24014	E8.84380	790	FRA
	U3827	*U. atrovirens*	RB, TU	1,19	2	1,2	2,0	N42.30477	E9.15027	460	FRA
UP1250	U3830	*U. bianorii*	ML	1,65	2	1,5	2,4	Lučanová unpubl.	Lučanová unpubl.	–	ESP
UP0688	U3837	*U. kioviensis*	LR	1,41	2	1,3	2,4	N48.24330	E17.25355	134	SVK
UP1229	U3840	*U. kioviensis*	PV, TU	1,43	2	1,1	2,0	N52.56075	E14.67413	13	POL
	U3838	*U. kioviensis*	LR	1,43	2	1,4	2,4	N48.24330	E17.25355	134	SVK
	U3839	*U. kioviensis*	LR	1,41	2	1,2	2,2	N48.24330	E17.25355	134	SVK
	U3841	*U. kioviensis*	FK	1,36	2	1,0	2,3	N48.67931	E16.94617	13	CZE
UP1248	U3842	*U. simensis*	FK	1,48	2	3,4	3,5	N7.04800	E39.76110	3332	ETH

Collectors: EZ – Eliška Záveská, FK – Filip Kolář, HC – Hana Chudáčková, JC – Jindřich Chrtek, LR – Ludmila Rejlová, ML – Magdalena Lučanová, PT – Pavel Trávníček, PV – Petr Vít, RB – Romana Bartošová, SH – Šárka Hořčicová, TU – Tomáš Urfus, ZC – Zuzana Chumová.

CASE STUDY II

Disparity between morphology and genetics in *Urtica dioica* (Urticaceae)

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Disparity between morphology and genetics in *Urtica dioica* (Urticaceae)

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Abstract

Polyploidization is generally considered a major evolutionary force that can alter the genetic diversity, morphology, physiology and ecology of plants. One striking example is the polyploid *Urtica dioica* complex, in which diploid taxa are often found in remote and partly relictual geographical ranges, in contrast to tetraploid individuals, which have an unknown evolutionary history and occur in a variety of synanthropic habitats. We used a set of 279 plants, evenly representing the geographical and morphological variation of *U. dioica s.l.* in Europe and Southwest Asia, and employed multivariate and geometric morphometrics and Hyb-Seq sequencing to estimate the extent of differentiation of diploid taxa and the ubiquitous tetraploid cytotype. Diploid subspecies form more-or-less separate clusters in morphological analyses, but our molecular evaluation did not reveal any structure. Moreover, tetraploids coalesced with diploids in both morphological and molecular analyses. This disparity between morphological and molecular data might be driven by (1) local adaptation of the diploid cytotype that is mirrored in specific phenotypes, (2) only recent genetic diversification of the group and (3) homoploid and heteroploid hybridization events.

Keywords: Hyb-Seq – multivariate morphometrics – phylogeny – polyploid complex – SNP analyses – *Urtica dioica*

Introduction

The evolutionary origin of weeds is a challenging topic that has recently been the focus of diverse research efforts (e.g. Divíšek *et al.,* 2018; Guo *et al.,* 2018), and two principal questions remain at the forefront of interest (Vilà *et al.,* 2010, 2011). Why do only certain weeds become rapid colonizers? What is their impact on native species and communities? Although it has become obvious that finding a set of traits associated with successful spread that would apply to all vascular plants is an unrealistic aim (Williamson, 1999), some determinants are widely accepted, e.g. wide environmental tolerance, self-compatibility, abundant seed set, effective seed dispersal, a short juvenile period, phenotypic plasticity, high relative growth rates and strong competitive ability (Baker & Stebbins, 1965; Levin, 2000). Besides other phenomena, polyploidy has been proposed as an important factor influencing weediness in plants, as it is believed that increased ecological tolerance of polyploids compared to their diploid counterparts enables them to colonize new habitats with greater ease (Stebbins, 1985; Barrett & Richardson, 1986; Pandit, Pocock & Kunin, 2011; te Beest *et al.,* 2012). However, there is still little evidence that polyploidy can enhance colonizing success in *Urtica* L. (Heiser & Whitaker, 1948).

Polyploidy (whole-genome duplication) is an important driver of evolution and a crucial mechanism of sympatric speciation (Otto, 1990; Otto & Whitton, 2000). It can alter both the genetic make-up (various responses to genomic shock, differential gene expression, masking of deleterious alleles etc.) and the morphology, physiology and ecology of plants. Many properties attributed to polyploidy, such as increased plant size, greater tolerance of abiotic stress, wider ecological tolerance or niche breadth, stronger affinity to disturbed habitats and greater resistance to fungal pathogens, are associated with the ability to colonize novel habitats (te Beest *et al.,* 2012; but see Glennon, Ritchie & Segraves, 2014).

Urtica dioica L. *s.l.*, the stinging nettle (for its delimitation see Grosse-Veldmann & Weigend, 2015; Grosse-Veldmann *et al.,* 2016), one of the most troublesome weeds, perfectly exemplifies a polyploid complex with relict and widespread taxa. The whole group is characterized by great variability, especially in the shape and indentation of leaves and the indumentum of the stem and leaf lamina (stinging vs. unicellular trichomes and considerable differences in their frequency; Weigend, 2005; Henning *et al.,* 2014; Grosse-Veldmann & Weigend, 2015). Whereas *U. dioica s.l.* seems to be well delimited (Henning *et al.,* 2014; Grosse-Veldmann *et al.,* 2016), the internal classification of the group is unstable and varies between sources (Domin, 1944; Geltman, 1990; Pollard & Briggs, 1982; Weigend, 2005, 2006; Henning *et al.,* 2014; Grosse-Veldmann & Weigend, 2015). Most intricate seems to be the infraspecific classification of *U. dioica* (*sensu* Grosse-Veldmann *et al.,* 2016). It includes several morphologically, geographically, cytologically (i.e. by ploidy) and ecologically more-or-less well-defined taxa, recently treated mostly at the subspecific rank (Geltman, 1988; Weigend, 2005, 2006; Grosse-Veldmann & Weigend, 2015). Two major ploidies (diploid and tetraploid) are reported in this species; besides that, rare triploids and pentaploids have also been reported (Rejlová *et al.,* 2019). Generally, the diploid subspecies tend to occur in relict, less human-affected habitats whereas tetraploids occur in habitats of all types, especially those with an increased degree of synanthropy, with the exception of the Po river basin region, where the diploid *U. dioica* subsp. *pubescens* Ledeb. (Ledebour, Bunge & Meyer, 1833) occurs in highly synanthropic conditions (Rejlová *et al.,* 2019). In Europe, all tetraploids are considered belonging to *U. dioica* subsp. *dioica*, and three or four subspecies are recognized at the diploid level, namely *U. d.* subsp. *pubescens* (individuals with a high density of unicellular trichomes on all parts, especially on the stem, give the plants a distinctly dove-grey appearance; stinging trichomes are present; the subspecies mostly occurs in drier places with southern orientation; Supporting Information, Fig. S1; Ledebour *et al.,* 1833; Geltman, 1984, 1988; Weigend, 2005), *U. dioica* subsp. *sondenii* (Simmons) Hylander (almost completely glabrous, without unicellular trichomes, fewer stinging trichomes, narrow leaves; its centre of occurrence is in the northern part of the Scandinavian Peninsula, where it grows in woodlands, along smaller streams and on scree slopes; Simmons, 1910; Jonsell, 2000), and *U. d.* subsp. *subinermis* (R.Uechtr.) Weigend (Weigend, 2005) (light green colour, almost without stinging trichomes, with fewer unicellular trichomes, elongated leaf lamina and a shifted phenology compared to tetraploid *U. dioica* subsp. *dioica*, flowering 14 days later; typical habitats are mainly near rivers and streams – alluvial habitats and wetland vegetation; Supporting Information, Fig. S1; Opiz, 1825; Pollard & Briggs, 1982, 1984a; Geltman, 1992; McAllister, 1999; Weigend, 2005). *Urtica dioica* subsp. *cypria* H.Lindb. (endemic to Cyprus) is also currently classified among diploid subspecies of *U. dioica* (Meikle, 1985; Weigend, 2006), despite doubts about its classification caused by a differing morphology and absolute genome size (Rejlová *et al.,* 2019). Whereas the diploid subspecies are supposed to be morphologically invariable, the tetraploid *U. dioica* subsp. *dioica* is morphologically highly variable, with several recognizable morphotypes that are stable in cultivation, interconnected by numerous intermediates (Geltman, 1986; Grosse-Veldmann & Weigend, 2015; Grosse-Veldmann, 2016). In south-western Asia (Anatolia), another subspecies, *U. dioica* subsp. *kurdistanica* Chrtek, is recognized at the diploid level. It is characterized by a high density of stinging trichomes, numerous short unicellular trichomes and strikingly indented leaves. Its typical habitats are verges of mountain roads, damp ditches, scree slopes, often at high elevations (Supporting Information, Fig. S1; Chrtek, 1974; Townsend & Guest, 1974; Weigend, 2006). Two other subspecies (*U. dioica* subspp. *Afghanica* Chrtek and *gansuensis* C.J.Chen; Chen *et al.,* 2003) have been described from Central Asia. Molecular approaches have not yet shed much light on the classification of this group. Next-generation-sequencing data (namely genotyping by sequencing, GBS) and standard plastid and nuclear markers failed to resolve any infraspecific relationships (Henning *et al.,* 2014; Grosse-Veldmann, 2016; Grosse-Veldmann *et al.,* 2016).

Despite long-lasting taxonomic inconsistencies and confusions, no detailed morphometric study interpreted in the framework of ploidal and genetic patterns has been carried out. To fill this gap, we applied a combination of multivariate and geometric morphometric and molecular approaches (Hyb-Seq) to a set of cytometrically analysed plants to (1) explore the delimitation of and relationships among European and south-western Asian diploid taxa growing in diverse ‘primary’ habitats, (2) elucidate the pattern of morphological and genetic variation in *U. dioica* and, if possible, also the origin of its tetraploids and (3) reveal the extent of morphological differentiation between diploids and tetraploids.

Material and methods

Plant material

Samples were collected between 2012 and 2018 across the range of *U. dioica* in Europe and south-western Asia and included all currently recognized subspecies (for locality details, see Supporting Information, Table S1). Ploidy of all plants was determined by flow cytometry, and all detected cytotypes were verified using chromosome counts, as described in (Rejlová *et al.,* 2019). In total, 248 plants (109 *U. dioica* subsp. *dioica*, 15 subsp. *kurdistanica*, 31 subsp. *pubescens*, 65 subsp. *subinermis*, 19 subsp. *sondenii*, nine tetraploid individuals from a mixed-ploidy population of subsp. *pubescens*; see also Supporting Information, Table S1, Fig. S2) were included in the morphometric dataset. Additionally, three vouchers of *U. dioica* subsp. *pubescens* (of unknown ploidy, but other plants from the region were proved to be diploid, Geltman, pers. comm.) originated from the Astrakhan region were obtained from D. Geltman (Saint Petersburg). For molecular analyses, a subset of the morphometric dataset representatively covering the geographical range was used (47 *U. dioica* subsp. *dioica*, two subsp. *kurdistanica*, nine subsp. *pubescens*, 18 subsp. *subinermis*; three subsp. *sondenii*, nine individuals from outgroups; see also Supporting Information, Table S1, Fig. S2). Voucher specimens are deposited in the Herbarium of Charles University, Prague (PRC; Supporting Information, Table S1).

Methods

Multivariate morphometrics

Thirty-four characters (Table 1) were measured or scored on herbarium specimens from our own collections (see also Supporting Information, Table S1). The selection of characters was made to include particularly those commonly used in the relevant literature (Tutin *et al.,* 1964; Chrtek, 1974; Townsend & Guest, 1974; Pignatti, 1982; Paiva, 1993; Jonsell, 2000; Weigend, 2005, 2006; Grosse-Veldmann & Weigend, 2015) with the addition of those that were identified as important during our field and herbarium studies. The characters were either measured directly on herbarium specimens, using a pair of calipers (characters 1 and 2, Table 1) or using ImageJ v.1.52a software with tools enabling exact distance measurement on smaller parts of plants (the measurements were performed on scanned leaves, with a calibration scale;

characters 12, 14–22, Table 1; Rasband, 2019). We evaluated two datasets: (1) a dataset comprising only diploid accessions and (2) a dataset with all individuals. To avoid distortion of multivariate analyses, Spearman's rank correlation coefficients were computed to reveal correlation structures among characters and to exclude high correlations (> 0.95) and to ensure that the datasets did not contain binary or multi-state data. Principal component analysis (PCA) based on a correlation matrix of characters and individual plants as operational taxonomic units was used to reduce the multidimensional nature of the character space and to reveal the overall pattern of morphological variation in the dataset. Canonical discriminant analysis (CDA) with individual plants assigned to groups based on ploidy was also performed. However, CDA was not performed at other levels of taxonomic delimitation, because of a lack of independent markers or traits that would unambiguously assign all individuals to a particular taxon. The analyses were performed in the R language statistical environment (R Core Team, 2018) with the help of the functions and scripts MorphoTools v.1.01 (Koutecký, 2015), using various R packages to achieve user-friendly data analysis (*ade4, class, permut, MASS, vegan*; Venables & Ripley, 2002; Dray, Dufour & Thioulouse, 2018; Oksanen *et al.,* 2019; Ripley *et al.,* 2019; Simpson, Bates & Oksanen, 2019).

Geometric morphometrics

A tendency to have narrow leaves is often reported in diploids (especially *U. dioica* subspp. *sondenii* and *subinermis* and other synonymized subspecies; Simmons, 1910; Pollard & Briggs, 1982, 1984a; Geltman 1992; McAllister, 1999; Jonsell, 2000; Weigend, 2005), so we proceeded to evaluate the shape of leaves. From each plant in the morphometric dataset, one leaf was removed (from the central part of the stem to capture fully developed leaves) and scanned (using a Canon CanoScan 9000 Mark II scanner at the resolution of 400 dpi). Using the program tpsDig v.2.31 (Rohlf, 2004), six main landmarks were placed on each leaf to represent its morphology, with 50 additional equidistant semilandmarks placed on the leaf margin to characterize the overall shape (Fig. 1). The statistical evaluation of data was based on the Klein & Svoboda protocol (Klein & Svoboda, 2017) in the R environment using various packages (*shapes, ggplot2, devtools, ellipse and roxygen2*; Wickham, 2016; Dryden, 2018; Murdoch & Chow, 2018; Wickham, Danenberg & Eugster, 2018a; Wickham, Hester & Chang, 2018b). Generalized Procrustes analysis was used to normalize the shapes to an equal scale, followed by PCA to visualize the overall pattern of morphological leaf variation. Distances between main landmarks were used as features in the multivariate morphometrics dataset (characters 23–37, Table 1).

Table 1. Characters used in the morphometric study.

No. of characters	Explanatory note	Unit of measurement
1	width of the stem (average for three measurement points per stem)	mm
2	length of internodes (average for five internodes)	mm
3	density of unicellular trichomes on the reverse side of the leaf	trichome count per cm^2
4	density of unicellular trichomes on the upper side of the leaf	trichome count per cm^2
5	density of stinging trichomes on the reverse side of the leaf	trichome count per cm^2
6	density of stinging trichomes on the upper side of the leaf	trichome count per cm^2
9	density of unicellular trichomes on the stem	trichome count per cm^2
	density of stinging trichomes on the stem	trichome count per cm^2
12	ratio of the length of the leaf and the length of the petiole (14/17)	
13	number of teeth on the leaf	count of the tooth
14	length of the leaf	mm
15	width of the leaf	mm
16	distance from the widest point of the leaf to the apex of the leaf	mm
17	length of the petiole	mm
18	ratio of the length and width of the leaf (14/15)	
19	tooth base width at the widest point of the leaf	mm
20	tooth height at the widest point of the leaf	mm
21	opposite tooth base width at the widest point of the leaf	mm
22	opposite tooth height at the widest point of the leaf	mm
23	distance between biologically homologous landmarks – AB	px
24	distance between biologically homologous landmarks – AC	px
25	distance between biologically homologous landmarks – AD	px
26	distance between biologically homologous landmarks – AE	px
27	distance between biologically homologous landmarks – AF	px
28	distance between biologically homologous landmarks – BC	px
29	distance between biologically homologous landmarks – BD	px
30	distance between biologically homologous landmarks – BE	px
31	distance between biologically homologous landmarks – BF	px
32	distance between biologically homologous landmarks – CD	px
33	distance between biologically homologous landmarks – CE	px
34	distance between biologically homologous landmarks – CF	px
35	distance between biologically homologous landmarks – DE	px
36	distance between biologically homologous landmarks – DF	px
37	distance between biologically homologous landmarks – EF	px

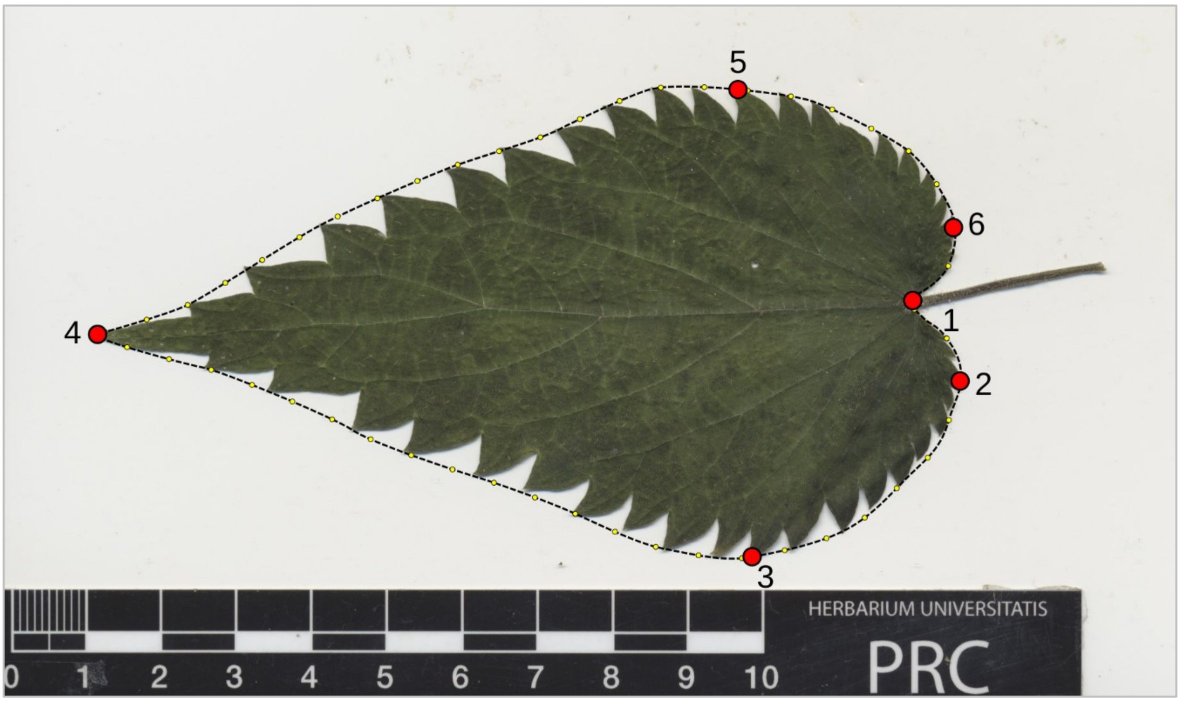

Figure 1. Geometric morphometrics: positions of six main landmarks (red points) and 50 additional equidistant semilandmarks (black line) on the leaf margin.

DNA extraction

Total genomic DNA was extracted from 0.5 g of dried leaf tissue using the DNeasy Plant Mini Kit (Qiagen, Valencia, CA, USA) and checked by 1% agarose gel electrophoresis using a Qubit 2.0 fluorometer (Invitrogen, Carlsbad, CA, USA).

Hyb-Seq – design of target enrichment probes

For the design of probes, samples U2029, U1772, U1729, U1682, U1322, U0501, U0174 and U0053 (see also Supporting Information, Table S1) were used. A DNA library was prepared with a NEBNext Ultra II DNA Library Prep Kit for Illumina (New England Biolabs, Ipswich, MA, USA) and sequenced on an Illumina MiSeq instrument (2 × 300 bp paired-end) at the OMICS Genomics laboratory, Biocev, Vestec. The library was sequenced in one run together with other seven libraries.

Low-copy nuclear (LCN) probes for target enrichment were designed based on a combination of transcriptome and genome skim data. The workflow of Sondovač (Schmickl et al., 2016) was used to harvest hundreds of orthologous LCN loci. Plastid and mitochondrial reads were removed using complete sequences of *Cannabis sativa* L. (GenBank accession numbers KY084475.1 and KU310670.1, respectively). Combined paired-end reads were matched against unique transcripts (*U. dioica* WKCY accession, assembly kindly provided by the One Thousand Plant Transcriptomes Initiative, 2019) using BLAT. Genome skim BLAT hits were *de novo* assembled with Geneious v.10.1.3 using medium sensitivity and the fast setting. Then, only contigs with exons longer than

600 bp were retained. In total, 4618 genes (≥ 600 bp) were assembled and final analysis resulted in 7744 exons (≥ 120 bp). Biotinylated RNA baits (100 nt, 2 × tilling density) were synthesized from our designed probes at Arbor Biosciences (Ann Arbor, MI, USA).

Library preparation and sequencing

In the first step, 600 ng to 1 µg of extracted DNA was sheared with the M220 Focused-ultrasonicator (Covaris, Woburn, MA, USA) using the program for fragmentation to 800 bp for 52 s (200 cycles at 6 °C). Library preparation followed the NEBNext Ultra DNA Library Prep (New England Biolabs, Ipswich, MA, USA) protocol for Illumina with a few modifications: (1) size selection (*c.* 500–600 bp) was performed on a 1% agarose gel; (2) two additional cleanup steps were implemented, one after adapter ligation with the QIAquick PCR Purification Kit (Qiagen, Venlo, Netherlands) and a second after gel extraction with the QIAquick Gel Extraction Kit (Qiagen) and (3) enriched PCR products were cleaned with the QIAquick PCR Purification Kit and subsequently with Agencourt AMPure XP beads (Beckman Coulter Genomics, Danvers, MA, USA). Amplification of ligated, size selected fragments was performed with eight cycles of PCR, using NEBNext Multiplex Oligos for Illumina Index Primers Set 1 and 2 (New England Biolabs) and twice cleaned with Agencourt AMPure XP beads (Beckman Coulter Genomics, Danvers, MA, USA, ratios 1:0.7 and 1:0.65 DNA:beads), and overall quality was checked by agarose electrophoresis and Qubit 2.0 fluorometer (Invitrogen, Carlsbad, CA, USA).

Libraries were subsequently pooled in approximately equimolar ratios in a 24-plex reaction (overall, five libraries were prepared). Solution hybridization with MyBaits biotinylated RNA baits (MYcroarray, Ann Arbor, MI, USA), which were synthesized from our custom-designed probes, and enrichment followed the MyBaits manual v.3.02 with *c.* 200 ng of input DNA (9 ng per accession), hybridization time of 26 h and 12 cycles of PCR enrichment, using KAPA HiFi HotStart DNA Polymerase (ThermoFisher Scientific, Wilmington, DE, USA), purification with the QIAquick PCR Purification Kit (Qiagen, Venlo, Netherlands) and quantification using Qubit 2.0 (Invitrogen, Carlsbad, CA, USA). Target-enriched libraries were sequenced on an Illumina MiSeq at the OMICS Genomics laboratory (of the Biological Section of Charles University, Biocev, Vestec) to obtain 150-bp paired-end reads.

Filtering of raw reads, read mapping and sequence alignment

We used the HybPhyloMaker v.1.6.4 pipeline (Fér & Schmickl, 2018) for raw read filtering, mapping of filtered reads to a pseudoreference, and construction of gene alignments. *PhiX* reads were removed with *Bowtie 2* (Langmead & Salzberg, 2012), *SAMtools* (Li *et al.,* 2009) and *bam2fastq* (Hudson Alpha Discovery, 2010). Adapter trimming and quality filtering were done using *Trimmomatic* (Bolger, Lohse & Usadel, 2014), and *FastUniq* (Xu *et al.,* 2012) was used for duplicate read removal. Mapping of filtered reads to a pseudoreference (exon sequences used for probe design, separated by strings of 400 Ns) was performed using *BWA* (Li & Durbin, 2009). A consensus sequence based on majority-rule consensus (majority threshold of 0.6) was generated with *kindel* (Constantinides & Robertson, 2017; Constantinides, 2019) and was then compared to the original exon sequences for each sample using *BLAT* (Kent, 2002) with a minimum sequence identity of 85. Consensus sequences were aligned using *MAFFT 7* (Katoh & Standley, 2013) with default settings, and sequences from nuclear exons of the same gene assembly were concatenated into genes using *AMAS* (Borowiec, 2016). The gene alignments were translated into amino acids using *Emboss* (Rice, Longden & Bleasby, 2000) for reading frame correction. We selected gene alignments with at least 90% species presence and subsampled alignments with the highest proportion of parsimony-informative sites. Gene alignments where sequences for individual samples consisted entirely of undetermined characters were excluded.

Species tree reconstruction from nuclear low-copy genes

The reconstruction of gene trees and a species tree was conducted using the HybPhyloMaker pipeline. Gene alignments with > 50% missing data and < 90% species presence were excluded from further analyses. Alignment characteristics were calculated using *AMAS* (Borowiec, 2016), trimAl v.1.4 (Capella-Gutierrez, Silla-Martinez & Gabaldon, 2009) and *MstatX* (Collet, 2012). Gene trees were reconstructed using RAxML v.8.2.4 (Stamatakis, 2014) with 1000 rapid bootstrap replicates (BS) and the *GTRGAMMA* model. Summary statistics were generated using *AMAS* (Borowiec, 2016) and plotted using R v.3.2.3 (R Core Team, 2018). The multispecies coalescent model implemented in ASTRAL v.5.6.1 (Mirarab *et al.,* 2014) was used to reconstruct a species trees with default settings. We collapsed branches with bootstrap support < 20% in all gene trees using *Newick* utilities (Junier & Zdobnov, 2010) before the reconstruction of a species tree with ASTRAL.

Selection of single nucleotide polymorphic sites (SNPs)

We used SNP sites (Page *et al.,* 2016) to extract SNPs from the 2175 gene alignments recovered before reading frame correction. To get only the most suitable SNPs for phylogenetic analysis, we used *bcftools* (Li, 2011) to filter the dataset. We excluded all sites at which no alternative alleles were called for any of the samples and sites at which only alternative alleles were called. Sites at which the proportion of missing data was > 20% were excluded and only bi-allelic SNPs were included in the final dataset. We used *bcftools* to reduce the dataset to include only SNPs with a minimum distance to each other of 100 bp.

We visualized genetic distances among individuals using principal coordinate analysis based on Euclidean distance (PCoA) calculated in the R package *adegenet* v.2.1.1 (Jombart, 2008; Jombart & Ahmed, 2011). The analyses were conducted separately for the diploid and tetraploid dataset.

Results

Multivariate morphometrics

In total, 248 individuals were included and processed in two ways (depending on the dataset). Characters not having normal distribution were log-transformed. Characters 16, 25, 26, 28, 29, 30, 32, 34 and 35 were excluded because they were highly correlated; Table 1. The PCA was used to show the overall pattern of morphological variation within both datasets. When analysing diploid accessions only (dataset 1), each of subspecies formed a more-or-less separate cluster (percentages of explained variation: PC1 – 39.38%, PC2 – 15.91%; Fig. 2).

Then we evaluated the entire polyploid complex of *U. dioica s.l.* (dataset 2). Tetraploids (*U. dioica* subsp. *dioica*) overlapped with diploids (*U. dioica* subspp. *subinermis* and *sondenii*), whereas *U. dioica* subspp. *kurdistanica* and *pubescens* formed partly distinguishable clusters (percentage of explained variation: PC1 38.7%, PC2 14.27%; Fig. 3).

Canonical discriminant analysis conducted on diploid and tetraploid data indicates only marginal differentiation of both cytotypes (Fig. 4). The most informative characters promoting such differentiation are connected with the density of unicellular trichomes (characters 3, 4, 9).

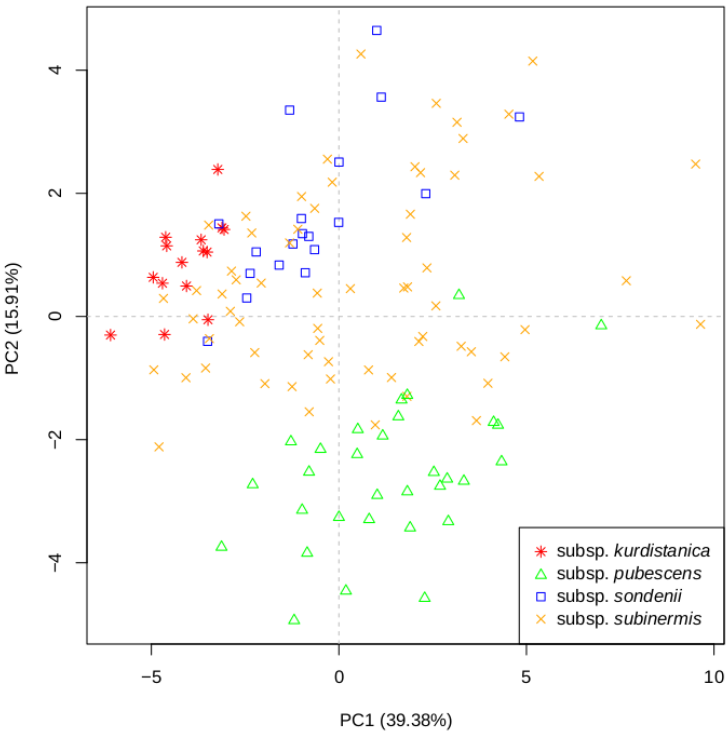

Figure 2. Multivariate morphometrics: principal component analysis (PCA) of diploid subspecies of *Urtica dioica* (subsp. *kurdistanica* = red stars, subsp. *pubescens* = green triangles, subsp. *sondenii* = blue squares, subsp. *subinermis* = orange crosses). The first and second axis are displayed with the indication of explained variation.

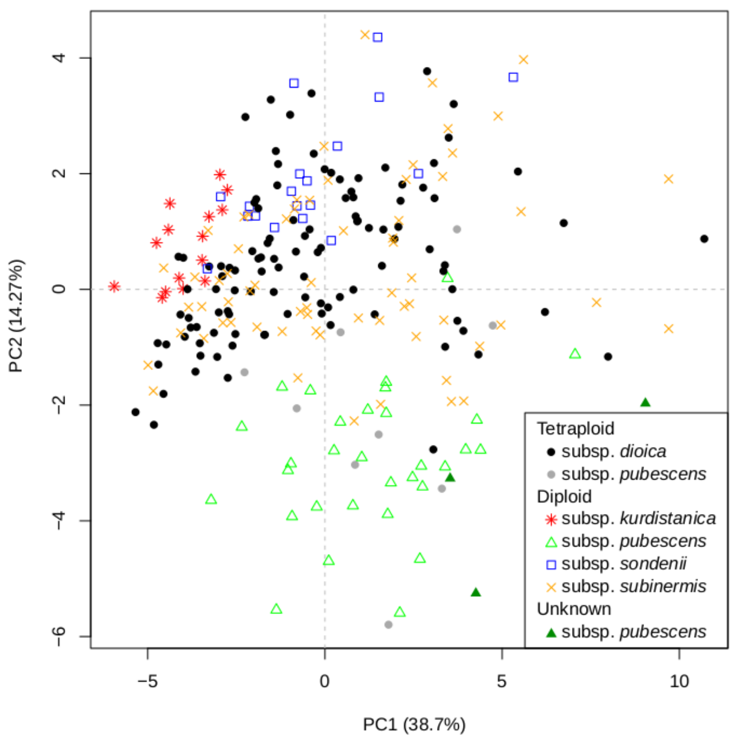

Figure 3. Multivariate morphometrics: principal component analysis (PCA) of all individuals from the polyploid complex of *Urtica dioica s.l.* Highlighted are tetraploid individuals of *U. dioica* subsp. *pubescens* from a mixed-ploidy population of diploid *U. dioica* subsp. *pubescens* (tetraploid individuals: *U. dioica* subsp. *dioica* = black points, subsp. *pubescens* = grey points; diploid subspecies: *U. dioica* subsp. *kurdistanica* = red stars, *U. dioica* subsp. *pubescens* = green triangles, *U. dioica* subsp. *sondenii* = blue squares, *U. dioica* subsp. *subinermis* = orange crosses; unknown ploidy: U. d. subsp. *pubescens* = dark green triangles; three vouchers originated from the Astrakhan region). The first and the second axis are displayed, with an indication of explained variation.

Geometric morphometrics

To evaluate the shape of leaves, the same dataset as for the multivariate morphometrics was used. First of all, we focused on the analysis of individuals categorized by ploidy (diploid vs. tetraploid), because diploids are often described as having narrow leaves when compared to tetraploids. Finally, a PCA examining the overall pattern in leaf shapes resulted in a large overlap between the groups (Supporting Information, Fig. S3), the percentage of explained variation being 64.9% for PC1 and 21.1% for PC2).

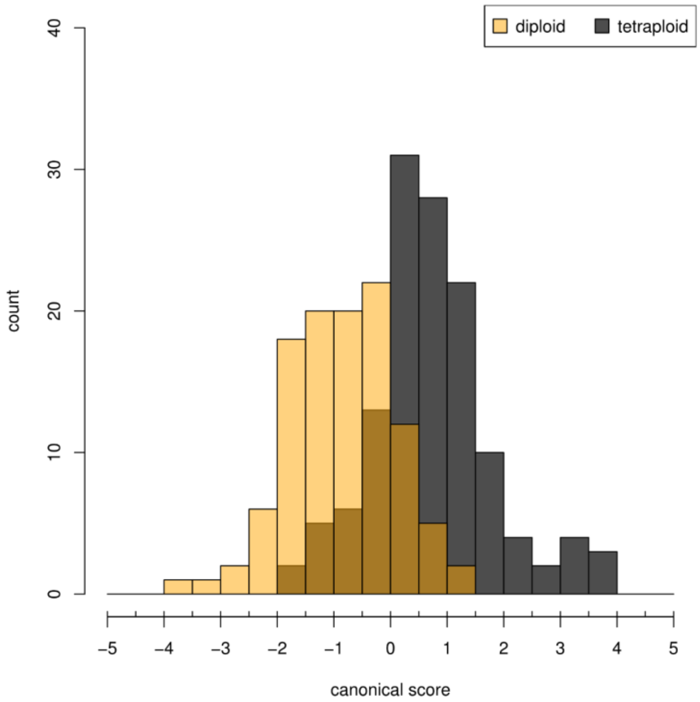

Figure 4. Multivariate morphometrics: discriminant analysis (DA) of diploids and tetraploids (light orange area = diploid cytotype, dark grey area = tetraploid cytotype, brown area = overlapping of both cytotypes). The features contributing the most to the variability were characters 3, 4 and 9 (for more details see Table 1).

Results of Hyb-Seq data processing

Raw reads per sample ranged from 167 570 (*U. dioica* subsp. *dioica* U1790) to 3 552 126 (*U. dioica* subsp. *subinermis* U1592), with an average of 1 567 122. Between 1.09 and 5.99% of reads were filtered out because of low quality, and 0.89 to 13.00% of duplicate reads were removed. This resulted in numbers of filtered reads ranging from 163 914
(*U. dioica* subsp. *dioica* U1790) to 3 394 948 (*U. dioica* subsp. *subinermis* U1592), with an average of 1 459 118. Raw reads are stored in the GenBank Sequence Reads Archive under accession number PRJNA602985.

Mapped reads to the target sequences of the hybridization probes ranged from80 451 (23.96%, *Cannabis ruderalis* Janisch. U2831) to 2 450 383 (75.82%, *U. dioica* subsp. *dioica* U2471), with an average of 1 157 890 (69.67%). A total of 2175 gene assemblies were recovered. After reading frame correction, this resulted in 1806 gene assemblies with alignment length ranging from 117 bp to 6426 bp. The average length of gene alignments was 772 bp. Of those alignments, 926 had < 50% of missing data. The percentage missing data among all gene alignments ranged from 0.02 to 99.91%, with an average of 47.64%.

The number of recovered genes per species ranged from 43 (*Cannabis ruderalis* U2831) to 1019 (*Urtica urens* L. U2875). We used conservative filtering and kept only gene alignments with 90% species presence, which decreased the amount of alignments to 818. We further subsampled alignments with the greatest proportion of potentially parsimony-informative sites and excluded gene alignments where sequences for individual samples consisted entirely of undetermined characters. This decreased the total number of genes to 249. The total alignment length was 289 647 bp, with 51 223 variable and 18 335 potentially parsimony-informative sites. The proportion of variable sites in the 249 gene alignments ranged from 8.3 to 26.8% (17.5% on average) and the proportion of potentially parsimony-informative sites ranged from 4.4 to 18.6% (6.4% on average).

Phylogeny of the *Urtica* group

In the species tree [Fig. 5, see also Supporting Information Fig. S4 (full version of the species tree)], ten *Urtica* groups are presented. Eight represent outgroups (*U. pilulifera* L., *U. urens*, *U. membranacea* Poir. Ex Savigny, *U. cypria*, two groups of *U. atrovirens* Req. ex Loisel., *U. gracilis* Aiton and *U. kioviensis* Rogow.) and two represent groups of *U. dioica*. In one of the *U. dioica* groups, seven Asian (from Georgia, Iran and Turkey) plants of *U. dioica* subsp. *dioica* cluster together, whereas in the second group, all remaining subspecies and also *U. dioica* subsp. *dioica* from the whole of Europe and two plants from Turkey cluster together with no additional pattern. The lack of resolution in Eurasian *U. dioica* (Supporting Information, Fig. S4) was also observed in analyses with different sets of gene alignments, e.g. filtered according to the number of potentially parsimony-informative sites or with increased numbers of genes (results not shown). The same pattern of lacking resolution in *U. dioica* was found when using introns (extracted using the HybPiper pipeline; Johnson *et al.*, 2016) flanking the targeted exon regions instead of gene alignments based on exons or combining intron and exon information (results not shown).

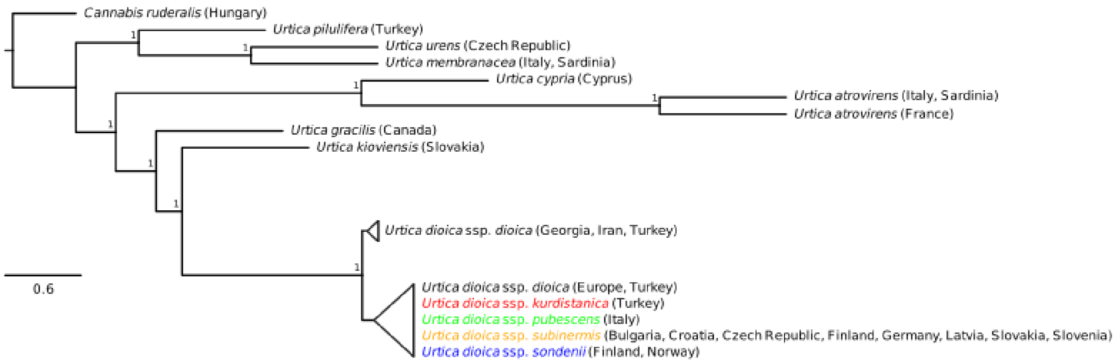

Figure 5. Phylogenetic reconstruction of evolutionary relationships among *Urtica* species based on coalescence analysis (ASTRAL) using 249 gene trees. Local posterior probabilities for the ASTRAL analysis are shown at the nodes. Branch length, representing substitutions per site, is indicated by the scale bar. Branches of *U. dioica* subsp. *dioica* from Europe, including two species from Turkey (U0559, U1765), and the diploid subspecies *U. dioica* subspp. *kurdistanica*, *subinermis*, *pubescens* and *sondenii* were collapsed into a polytomy forming a sister clade to seven Asian species from Iran, Georgia and Turkey. The full version of the tree is shown in Figure S4.

SNP analyses

Extraction of SNPs from the gene alignments resulted in 427 633 sites and 26 052 biallelic sites after filtering. The number of SNPs decreased to 2135 when only considering independent sites that were at least 100 bp apart from each other. Only weak or no clustering was found in the analysis of diploids in the PCoA analysis based on these independent SNPs (Fig. 6A), resulting also in non-structured output in *fastStructure* analysis (data not shown). This absence of differentiation between taxa is in accordance with the lack of support for diploid taxa in the species tree (see above). In contrast, tetraploids exhibit clear separation of individuals from the Middle East (Fig. 6B) and it corresponds well with the splitting of tetraploids into two separate branches of the species tree.

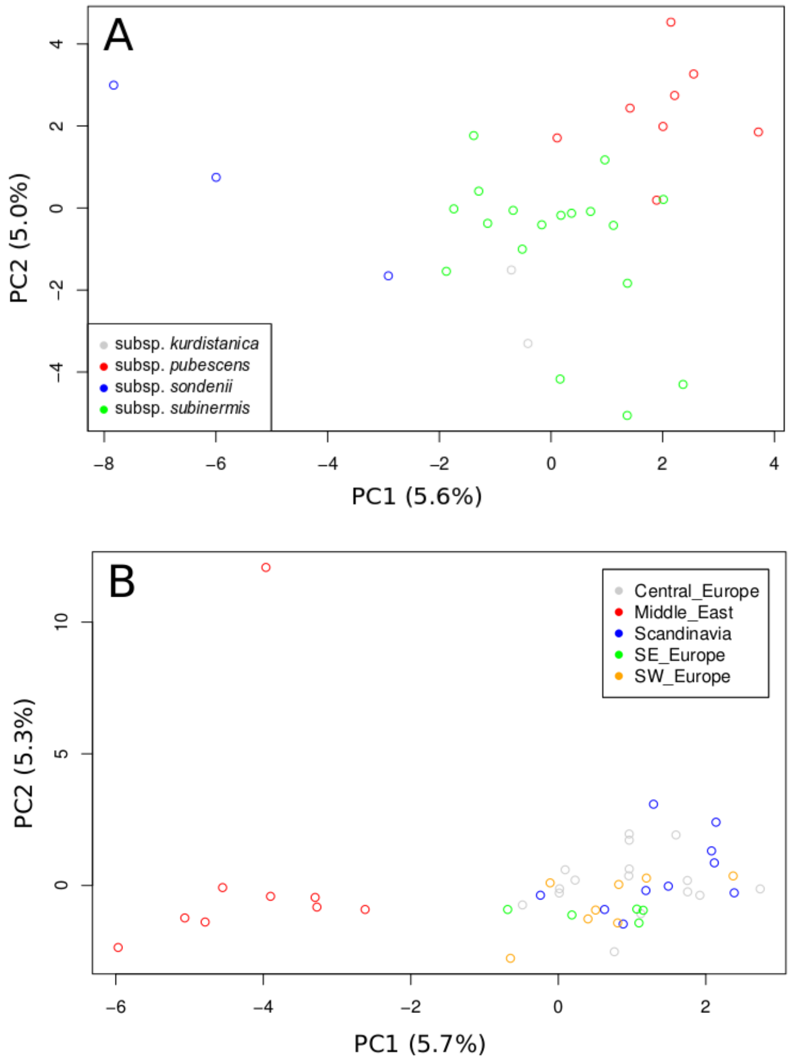

Figure 6. Principal coordinate (PCoA) of A, diploid taxa and B, tetraploid individuals based on 2135 SNP sites revealed by the Hyb-Seq approach. The first and the second axis are displayed together with information on explained variation.

Discussion

We applied target enrichment combined with genome skimming (Hyb-Seq) and morphometric analyses to assess the differentiation of several diploid taxa and tetraploids of *U. dioica*, as proposed by Rejlová *et al.* (2019). Although our study revealed a certain degree variation in morphology that is at least partly structured along boundaries between accepted infraspecific units (subspecies), we failed to resolve infraspecific relationships in *U. dioica* using molecular data, which contradicts the frequent association between these groups of traits. Despite using the Hyb-Seq approach to next-generation sequencing, which usually provides robust phylogenetic trees based on hundreds of low-copy genes (Weitemier *et al.,* 2014; Dodsworth *et al.,* 2019), our effort to distinguish morphologically well separated taxa failed entirely. Similar studies employing Sanger sequencing (Henning *et al.,* 2014; Grosse-Veldmann *et al.,* 2016) or the RAD-Seq technique (Grosse-Veldmann, 2016) have yielded similar results. Considering the versatility of both NGS-based approaches, allowing their usage for deep and shallow taxonomic units (Mandel *et al.,* 2017; Gernandt *et al.,* 2018; Villaverde *et al.,* 2018), these multiple lines of proof corroborate the hypothesis that these failures to differentiate taxa are of a systemic nature associated with the life history of *U. dioica s.l.,* not caused by methodological biases.

Well-differentiated ancestral diploid taxa?

The lack of genetic divergence among diploid plants (assigned to *U. dioica* subspp. *sondenii*, *pubescens*, *subinermis* or *kurdistanica*), despite morphological differentiation (more-or-less separated clusters corresponding with subspecies), might suggest relatively recent differentiation. This is in accordance with the dated phylogenetic tree of Wu *et al.* (2018), estimating the origin of the crown clade at 2.4–2.0 Mya. Further, we consider two possible scenarios leading to the limited genetic diversification in *Urtica*: (1) rapid spread of such a recently evolved group following the fragmentation of its, potentially large, ancestral geographical range; and (2) a rapid expansion from a limited number of source populations. Trait plasticity in response to pasture and changing light conditions should also be considered (Thurston & Lersten, 1969; Pollard & Briggs, 1984b), along with life-history traits of *U. dioica* such as obligate outcrossing, wind pollination (i.e. possible long-distance dispersal of pollen grains) and vegetative spread by underground stolons (Winkler & Fischer, 2002; Wright & Davis, 2006). The types of habitats in which diploids grow also lend support to the recent differentiation of the *U. dioica* group, because they are mainly confined to places of Holocene origin (Wang *et al.*, 2014; Roberts *et al.,* 2018).

First, densely hairy plants from the Po river basin and from the Volga river delta, assigned to *U. dioica* subsp. *pubescens*, were clearly separated along the second PCA axis. This is in line with the delimitation of *U. dioica* subsp. *pubescens* proposed by Weigend (2005), who used this name for plants from southeastern Europe, reaching westwards to Italy and eastwards to the Volga river delta near the town of Astrakhan. In contrast, Geltman (1986, and revised herbarium vouchers in LE) treated this taxon as endemic to the Volga river delta, the vicinity of the towns of Pyatigorsk in the foothills of the Caucasus Mts and Kherson in the Dnieper river delta, and Crimea. Weigend (2005) also pointed out that *U. dioica* subsp. *pubescens* is more drought-tolerant than *U. dioica* subsp. *subinermis* (synonym *U. galeopsifolia* Wierzb. ex Opiz), which does not fully correspond with data from herbarium labels or with our observations. Plants in the Volga river delta occur in stands of Phragmites Adans. along river banks (Geltman, 1986), which contradicts the protologue (*in vineis*, Ledebour, *et al.,* 1833). Plants in the Po river basin inhabit exclusively highly synanthropic and strongly human-affected banks of water channels (Rejlová *et al.,* 2019).

Secondary contact zones and gene flow between diploid subspecies possibly exist. Based on our morphological data, plants intermediate between *U. dioica* subspp. *pubescens* and *subinermis* were detected along the biogeographical border between hills of the Mediterranean and Dinaric plateaus and hills close to the towns of Vipava and Ajdovščina in south-western Slovenia. However, contact zones are probably more frequent. For example, Geltman (1986) reported morphologically intermediate plants between the same parental subspecies from the Saratov region by the river Volga in southern European Russia. We also observed a contact zone between *U. dioica* subspp. *sondenii* and *subinermis* in Fennoscandia. Although hybridization between diploid subspecies of *U. dioica* is yet to be proved experimentally, it seems probable, as hybrids have been confirmed, for example, between *U. dioica* and *U. kioviensis* (Buchwald *et al.,* 2013; Rejlová & Urfus, 2018; Karlsson & Agestam, 2019). Moreover, a recent study (Rejlová *et al.,* 2019) provides evidence of inter-cytotype crossing in *U. dioica*.

Origin of tetraploids

Tetraploids of *U. dioica*, mostly referred to as *U. dioica* subsp. *dioica*, are widely distributed in a range of synanthropic habitats and have a cosmopolitan distribution (Meusel, Jäger & Weiner, 1965; Rejlová *et al.,* 2019). Our molecular phylogenetic tree revealed two groups, one comprising European plants (with all diploids) and the other encompassing plants from south-western Asia (Anatolia, Iran and Georgia). This raises the question about the evolutionary origin of Asian tetraploids, as they are most probably not derived from the partly co-occurring diploids assigned to *U. dioica* subsp. *kurdistanica*. This can be explained, for example, by sampling bias, as the sampling density in Asia was lower than in Europe, or at least some parts of it, so ancestral diploids might not have been included in our sample set. Other possible explanations are that tetraploids originated outside our study area from sympatric diploids and migrated into the area covered by our study, or that hybridization takes place at the tetraploid level.

We did not find any clear structure, with either SNPs or Hyb-Seq, in the cluster of European samples, which is generally in line with the lack of a clear structure in the morphometric data and also with a reticulate variation reflected in the highly complicated infra-subspecific taxonomy of *U. dioica* subsp. *dioica* (Weigend, 2005; Henning *et al.,* 2014; Grosse-Veldmann & Weigend, 2015; Grosse-Veldmann, 2016). However, one exception are tetraploid plants collected in a mixed-ploidy population with diploids assigned to *U. dioica* subsp. *pubescens* in the Po river basin. These tetraploids and diploids are grouped together in our morphometric analyses. This means that the name *U. dioica* subsp. *pubescens* is based on diploid but also refers to tetraploids, probably of autopolyploid origin. The evolutionary history of the remaining European tetraploids remains unresolved. Our morphometric analysis also shows an overlap between tetraploids and diploid plants assigned to *U. dioica* subspp. *subinermis* and *sondenii*, which might indicate the participation of these plants in either the auto- or allopolyploid origin of tetraploids. The pattern can be further obscured by hybridization between tetraploids, which has never been proved but cannot be excluded with certainty, and, last but not least, by human-induced spread (Domin, 1944; Ivins, 1952; Geltman, 1986; Šrůtek & Teckelmann, 1998). To sum up, both the rapid spread of tetraploids from a few source population and polytopic origins should be taken into consideration. Here, we only provide evidence concerning the distinct origin of tetraploid plants sympatric with diploids of *U. dioica* subsp. *pubescens*.

The evolutionary history of tetraploids might be further obscured by inter-cytotype gene flow, either via triploid bridge or, even cryptically, by fusion of unreduced gametes of diploids and reduced gametes of tetraploids. That gene flow occurs in mixed populations has already been proved by Rejlová *et al.* (2019), but its role in evolutionary history remains unknown. On the other hand, the lack of any significant genetic structure in the complex fuels speculation on the mutual intermingling of various diploids and tetraploids in the past.

***Urtica dioica* s.l.**

Although a wide spectrum of molecular markers failed to resolve any structure within *U. dioica*, its delineation in relation to the closely related species *U. kioviensis* and *U. gracilis* seems to be clear-cut, as Henning *et al.* (2014) obtained generally the same topology using GBS. We have also confirmed the position of *U. dioica* subsp. *cypria*, an endemic of Cyprus, outside of the *U. dioica s.s.* clade. Here it forms a clade together with *U. atrovirens*, sister to the Eurasian clade of *U. dioica* and *U. gracilis*. Nearly the same topology was revealed by ITS, four plastid DNA markers and GBS (Grosse-Veldmann, 2016; Grosse-Veldmann *et al.,* 2016). The exclusion of *U. dioica* subsp *cypria* from *U. dioica* is also supported by differences in genome size (*U. dioica* subsp. *cypria*: mean Cx-value = 0.55 ± 0.005, 2C-value range 1.65–1.67 pg; difference compared to 2x (%) = 44.4, difference compared to 4x (%) = 23.9; Rejlová *et al.,* 2019), and a taxonomic re-evaluation is therefore needed.

Conclusions

Our data provide additional significant insight into the intricate polyploid complex of *U. dioica s.l.* and contribute to the elucidation of the high phenotypic plasticity and phylogenetic relationships within it and with closely related species. Our morphometric analysis has contributed to the delimitation of diploid subspecies (*U. dioica* subspp. *kurdistanica*, *pubescens*, *sondenii* and *subinermis*), which form more-or-less separated clusters. However, the inclusion of tetraploid individuals (*U. dioica* subsp. *dioica*), the high phenotypic plasticity of which was already evident from our field observations, largely obscures the distinctness of diploids. Discriminant analysis of individual plants assigned to groups based on ploidy demonstrated that the characters contributing the most to the separation of diploids and tetraploids are associated with the density of unicellular trichomes on different parts of the plants. Molecular analyses revealed no structure with respect to either cytotype differentiation or differences between morphologically defined diploid subspecies. Among tetraploid individuals, SNPs exhibit clear differentiation of tetraploids from the Middle East, corresponding with the split of tetraploids into two separate branches on the species tree. Our molecular analyses also contribute to the separation of the closely related species *U. cypria*, endemic to the Mediterranean region, formerly classified as a diploid subspecies of *U. dioica*. Because molecular methods have so far failed to find any structure in the intricate intraspecific variability and relationships in *U. dioica*, only highly sensitive approaches, such as whole-genome sequencing or oligopaint FISH, might shed new light on the evolution of this diploid-tetraploid complex.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Table S1. Overview of *Urtica dioica* samples included in morphometric and molecular analyses.

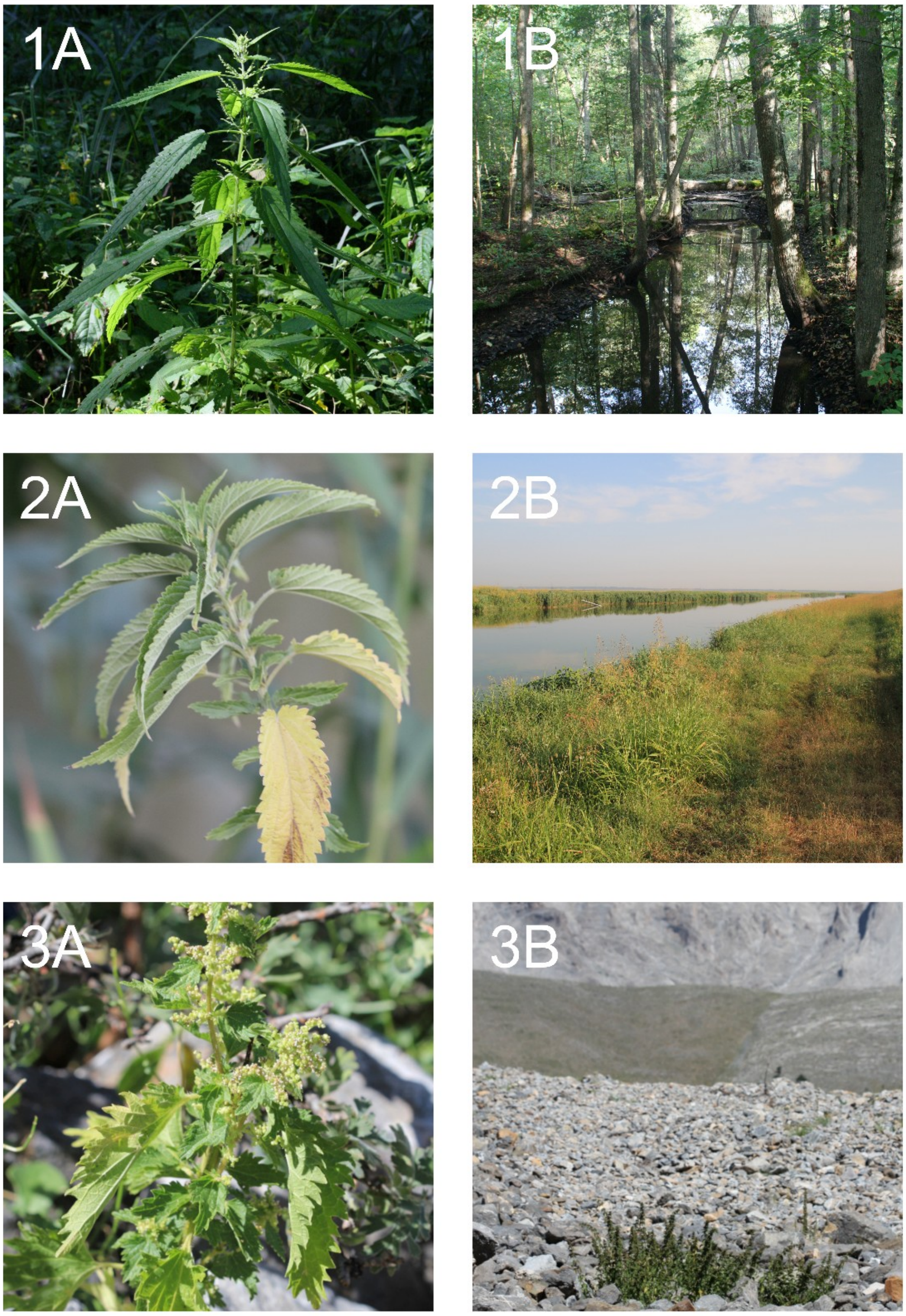
Figure S1. Diploid phenotypes of *Urtica dioica* and typical habitat of occurrence (*U. dioica* subsp. *subinermis* = 1A, 1B; *U. dioica* subsp. *pubescens* = 2A, 2B; *U. dioica* subsp. *kurdistanica* = 3A, 3B; photographs, L. Rejlová and T. Urfus).

Figure S2. Sampling location of accessions investigated (red squares = morphometrics dataset, blue crosses = molecular dataset; for locality details see Table S1).

Figure S3. Geometric morphometrics: principal component analysis (PCA) of all individuals from the polyploid complex of *Urtica dioica s.l.* (tetraploid individuals: *U. dioica* subsp. *dioica* = black points; diploid subspecies: *U. dioica* subsp. *kurdistanica* = red points, subsp. *pubescens* = green points, subsp. *sondenii* = blue points, subsp. *subinermis* = orange points). The first and second axis are displayed, with an indication of explained variation.

Figure S4. Phylogenetic reconstruction of evolutionary relationships among *Urtica* species based on coalescence analysis (ASTRAL) using 249 gene trees. Local posterior probabilities for the ASTRAL analysis are shown at the nodes. Branch length, representing substitutions per site, is indicated by the scale bar. The location (the country where samples were taken) and ploidy level of *U. dioica s.l.* samples are indicated following the sample ID (for more details see Table S1).

Supporting information



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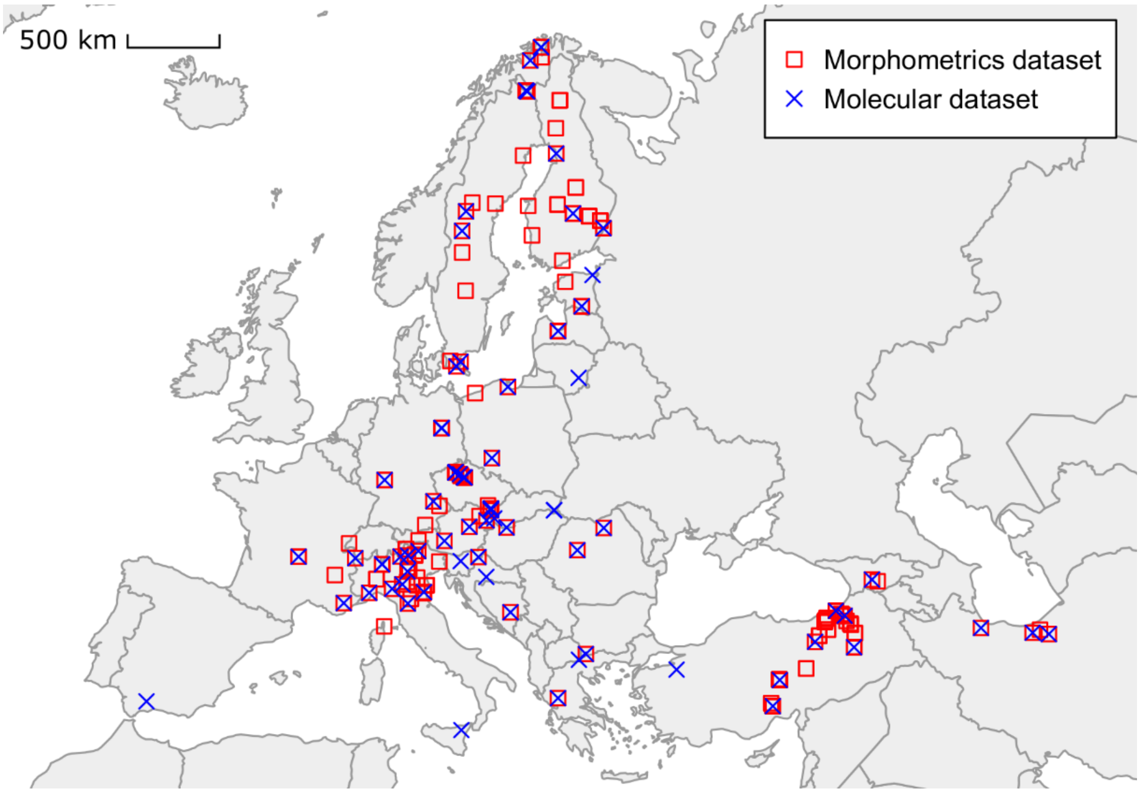

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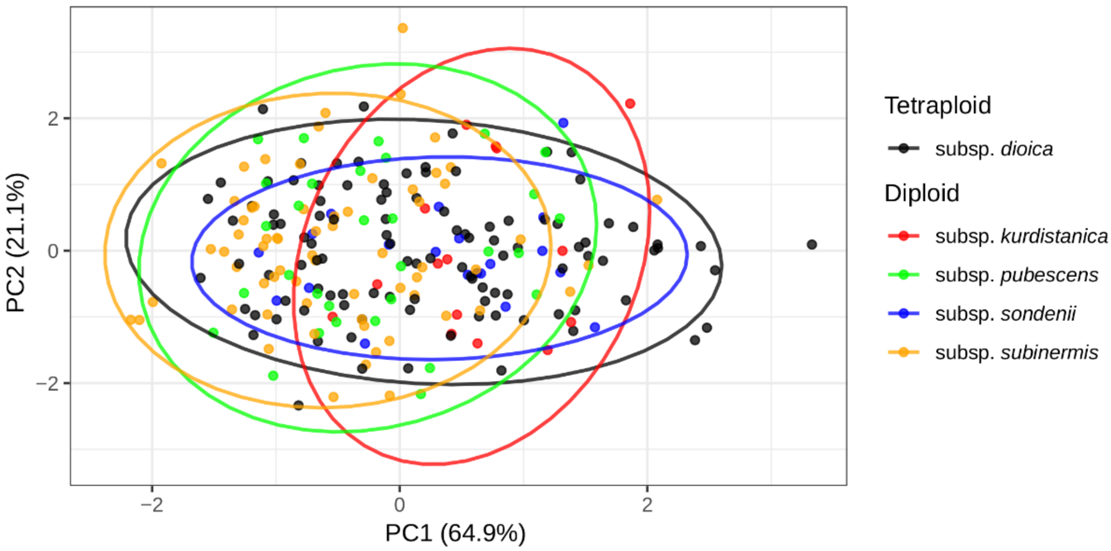

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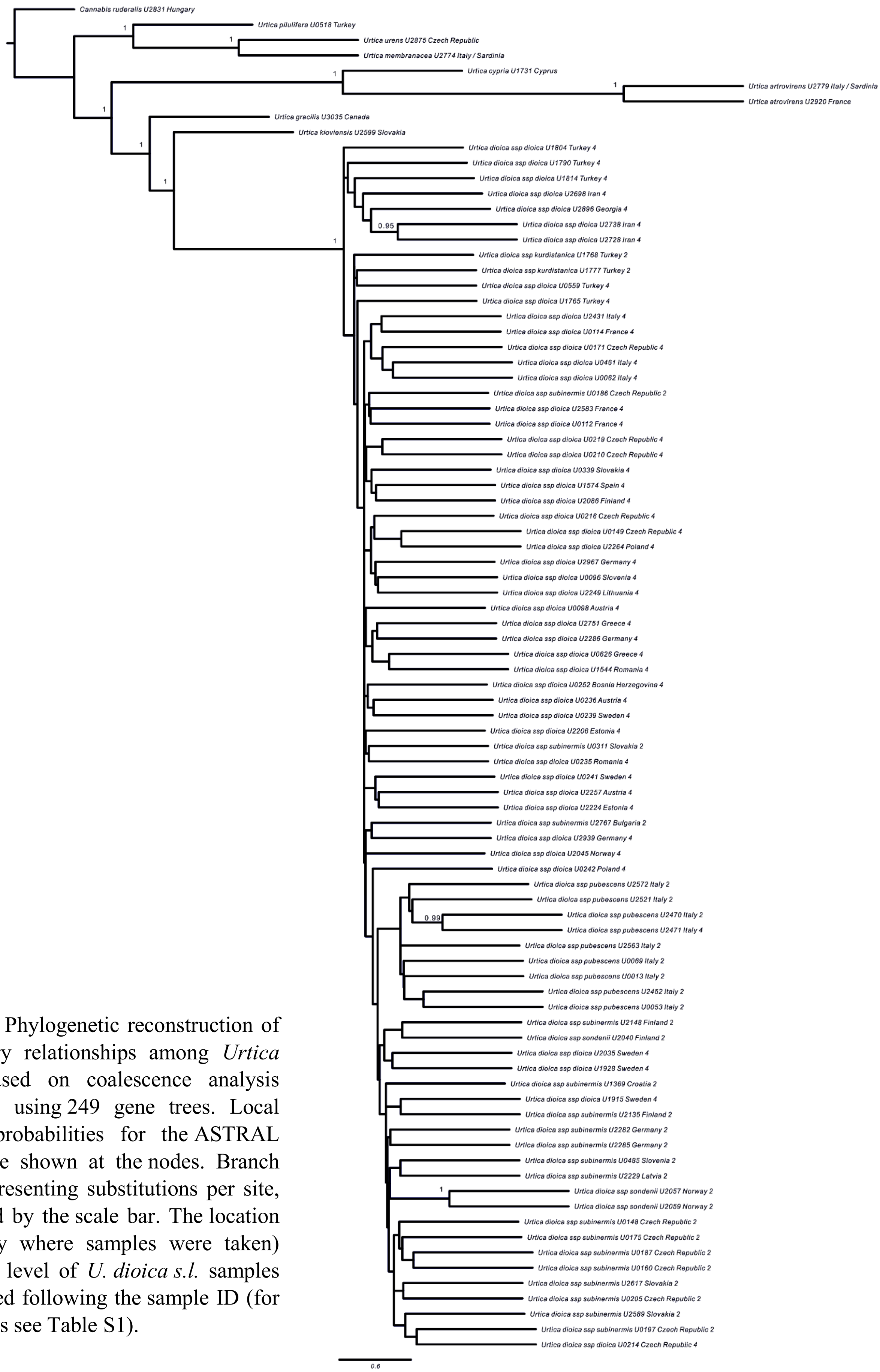

Figure S4. Phylogenetic reconstruction of evolutionary relationships among *Urtica* species based on coalescence analysis (ASTRAL) using 249 gene trees. Local posterior probabilities for the ASTRAL analysis are shown at the nodes. Branch length, representing substitutions per site, is indicated by the scale bar. The location (the country where samples were taken) and ploidy level of *U. dioica s.l.* samples are indicated following the sample ID (for more details see Table S1).

Table S1. Overview of *Urtica dioica* samples included in morphometric and molecular analyses.

ID number of population	ID number of analysis	ID number of voucher specimens	Molecular analysis	Morphometrics analysis	Taxon	DNA-ploidy level	Collector	Latitude (WGS-84)	Longitude (WGS-84)	Altitude (m a.s.l.)	Country (ISO 3166-1)	Total nr. reads	Nr. reads after quality filtering (% low quality)	Nr. reads without duplicates (% duplicates)	Nr. map. low-copy gene reads (% LCG reads)	No. mapped genes	Missing data LCG
UP0002	U0003	PRC-438804		•	subsp. *dioica*	4	PT, TU	N47.83019	E11.90803	706	DEU	—	—	—	—	—	—
UP0006	U0013	PRC-438805	•	•	subsp. *pubescens*	2	PT, TU	N46.56411	E11.51614	433	ITA	1 397 918	1,363,043 (2.5)	1,331,795 (2.3)	877,083 (64.3)	911	10,6
UP0007	U0019	PRC-438806		•	subsp. *pubescens*	2	PT, TU	N46.37231	E11.27297	230	ITA	—	—	—	—	—	—
	U0020	PRC-438863		•	subsp. *pubescens*	2	PT, TU	N46.37231	E11.27297	230	ITA	—	—	—	—	—	—
UP0008	U0023	PRC-438864		•	subsp. *pubescens*	2	PT, TU	N46.34064	E11.28606	235	ITA	—	—	—	—	—	—
	U0026	PRC-438865		•	subsp. *pubescens*	2	PT, TU	N46.34064	E11.28606	235	ITA	—	—	—	—	—	—
UP0009	U0032	PRC-438866		•	subsp. *pubescens*	2	PT, TU	N45.69819	E10.92406	124	ITA	—	—	—	—	—	—
UP0010	U0033	PRC-438867		•	subsp. *dioica*	4	PT, TU	N45.64967	E10.93133	872	ITA	—	—	—	—	—	—
	U0037	PRC-438868		•	subsp. *dioica*	4	PT, TU	N45.64967	E10.93133	872	ITA	—	—	—	—	—	—
UP0011	U0039	PRC-438869		•	subsp. *pubescens*	2	PT, TU	N45.28419	E11.54436	14	ITA	—	—	—	—	—	—
UP0013	U0049	PRC-438870		•	subsp. *pubescens*	2	PT, TU	N44.91133	E11.59153	8	ITA	—	—	—	—	—	—
UP0015	U0053	PRC-438871	•	•	subsp. *pubescens*	2	PT, TU	N44.60553	E12.09756	1	ITA	1 591 210	1,533,788 (3.6)	1,509,974 (1.6)	1,027,622 (65.2)	968	10,1
	U0054	PRC-438872		•	subsp. *pubescens*	2	PT, TU	N44.60553	E12.09756	1	ITA	—	—	—	—	—	—
UP0016	U0056	PRC-438873		•	subsp. *dioica*	4	PT, TU	N44.54508	E12.06253	2	ITA	—	—	—	—	—	—
UP0017	U0059	PRC-438874		•	subsp. *pubescens*	2	PT, TU	N44.24497	E11.19314	346	ITA	—	—	—	—	—	—
	U0060	PRC-438875		•	subsp. *dioica*	4	PT, TU	N44.24497	E11.19314	346	ITA	—	—	—	—	—	—
	U0061	PRC-438876		•	subsp. *dioica*	4	PT, TU	N44.24497	E11.19314	346	ITA	—	—	—	—	—	—
UP0018	U0062	PRC-438905	•	•	subsp. *dioica*	4	PT, TU	N44.00511	E11.0095	831	ITA	2 507 822	2,441,693 (2.6)	2,403,343 (1.6)	1,759,892 (71.1)	1 017	10,1
UP0019	U0064	PRC-438906		•	subsp. *pubescens*	2	PT, TU	N45.04953	E10.84967	20	ITA	—	—	—	—	—	—
UP0020	U0069	PRC-438907	•	•	subsp. *pubescens*	2	PT, TU	N45.54856	E10.81933	101	ITA	1 868 088	1,820,951 (2.5)	1,784,075 (2.0)	1,555,597 (83.7)	950	10,7
	U0070	PRC-438908		•	subsp. *pubescens*	2	PT, TU	N45.54856	E10.81933	101	ITA	—	—	—	—	—	—
UP0022	U0074	PRC-438909		•	subsp. *dioica*	4	PT, TU	N47.06294	E11.47494	1349	AUT	—	—	—	—	—	—
UP0025	U0096	PRC-440806	•	•	subsp. *dioica*	4	PT, TU	N46.37277	E15.9959	198	SVN	1 658 860	1,628,009 (1.9)	1,597,779 (1.9)	1,168,560 (71.7)	902	9,9
UP0026	U0098	PRC-438910	•	•	subsp. *dioica*	4	PT, TU	N48.12678	E16.60739	157	AUT	1 657 528	1,608,872 (2.9)	1,575,636 (2.1)	995,724 (61.9)	938	10,7
UP0029	U0108	PRC-438911		•	subsp. *dioica*	4	PT, TU	N48.33775	E16.06386	177	AUT	—	—	—	—	—	—
UP0030	U0112	PRC-438912	•	•	subsp. *dioica*	4	PT, ZC	N45.58577	E2.79005	973	FRA	953 034	931,221 (2.3)	913,567 (1.9)	699,001 (74.1)	907	10,6
	U0132	PRC-438916		•	subsp. *dioica*	4	PT, ZC	N45.58577	E2.79005	973	FRA	—	—	—	—	—	—

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UP0031	U0114	PRC-438913	•	•	subsp. *dioica*	4	PT, ZC	N43.71287	E6.50527	901	FRA	2 105 938	2,046,574 (2.8)	2,005,534 (2.0)	1,395,814 (68.1)	976	10,6
UP0032	U0119	PRC-438914		•	subsp. *dioica*	4	PT, ZC	N44.99695	E5.6029	1079	FRA	—	—	—	—	—	—
UP0034	U0122	PRC-438915		•	subsp. *dioica*	4	PT, ZC	N46.59936	E6.31844	1615	CHE	—	—	—	—	—	—
UP0042	U0148	PRC-438917	•	•	subsp. *subinermis*	2	LR	N48.68281	E16.93925	153	CZE	1 338 758	1,300,493 (2.9)	1,269,723 (2.4)	812,150 (62.5)	915	10,2
UP0043	U0149	PRC-438918	•	•	subsp. *dioica*	4	LR	N48.68231	E16.94206	160	CZE	955 780	925,428 (3.2)	911,652 (1.5)	591,758 (63.6)	906	10,2
UP0045	U0151	PRC-438947		•	subsp. *subinermis*	2	LR	N48.66864	E16.939	154	CZE	—	—	—	—	—	—
UP0048	U0156	PRC-438948		•	subsp. *dioica*	4	LR	N48.61758	E16.94042	155	CZE	—	—	—	—	—	—
UP0049	U0158	PRC-438949		•	subsp. *subinermis*	2	LR	N48.61847	E16.94081	155	CZE	—	—	—	—	—	—
UP0050	U0160	PRC-438950	•	•	subsp. *subinermis*	2	LR	N48.6185	E16.94103	156	CZE	1 552 886	1,499,304 (3.5)	1,469,348 (2.0)	959,280 (63.3)	937	9,8
UP0053	U0166	PRC-438951		•	subsp. *subinermis*	2	LR	N48.62306	E16.93511	152	CZE	—	—	—	—	—	—
UP0057	U0171	PRC-438952	•	•	subsp. *dioica*	4	LR	N48.63972	E16.95794	156	CZE	2 469 002	2,409,263 (2.4)	2,368,915 (1.7)	1,715,513 (70.8)	1 008	9,9
UP0059	U0174	PRC-439190	•		subsp. *subinermis*	2	LR	N48.66172	E16.95553	154	CZE	—	—	—	—	—	—
UP0060	U0175	PRC-438953	•	•	subsp. *subinermis*	2	LR	N48.70031	E16.96467	165	CZE	1 818 970	1,754,362 (3.6)	1,731,816 (1.3)	1,295,201 (71.8)	971	9,8
UP0062	U0178	PRC-438954		•	subsp. *dioica*	4	LR	N48.65686	E16.93314	151	CZE	—	—	—	—	—	—
UP0063	U0181	PRC-438955		•	subsp. *dioica*	4	LR	N48.62083	E16.94406	158	CZE	—	—	—	—	—	—
UP0064	U0182	PRC-438956		•	subsp. *subinermis*	2	LR	N48.64	E16.94053	151	CZE	—	—	—	—	—	—
	U0183	—		•	subsp. *subinermis*	2	LR	N48.64	E16.94053	151	CZE	—	—	—	—	—	—
UP0066	U0186	PRC-438958	•	•	subsp. *subinermis*	2	LR	N48.65292	E16.94225	159	CZE	1 186 106	1,160,961 (2.1)	1,037,453 (10.6)	743,527 (70.1)	864	10,6
UP0067	U0187	PRC-438957	•	•	subsp. *subinermis*	2	LR	N48.65369	E16.94275	166	CZE	1 594 270	1,540,496 (3.4)	1,500,920 (2.6)	1,022,302 (66.3)	965	10,1
UP0068	U0188	PRC-438959		•	subsp. *subinermis*	2	LR	N48.65456	E16.94178	161	CZE	—	—	—	—	—	—
UP0071	U0191	PRC-438960		•	subsp. *subinermis*	2	LR	N50.28453	E14.50793	168	CZE	—	—	—	—	—	—
UP0072	U0192	PRC-439017		•	subsp. *dioica*	4	LR	N50.27928	E14.51105	169	CZE	—	—	—	—	—	—
UP0074	U0194	PRC-439018		•	subsp. *subinermis*	2	LR	N50.28723	E14.50978	168	CZE	—	—	—	—	—	—
UP0077	U0197	PRC-439019	•	•	subsp. *subinermis*	2	LR	N50.18072	E14.78853	184	CZE	1 671 506	1,606,626 (3.9)	1,573,720 (2.1)	1,060,772 (65.3)	971	10,3
UP0081	U0201	PRC-439020		•	subsp. *subinermis*	2	LR	N50.1821	E14.78067	184	CZE	—	—	—	—	—	—
UP0084	U0205	PRC-438835/36	•	•	subsp. *subinermis*	2	LR	N50.39711	E14.08478	167	CZE	2 655 076	2,592,575 (2.4)	2,532,483 (2.3)	2,204,479 (83.9)	952	11,0
UP0086	U0208	PRC-439021		•	subsp. *dioica*	4	LR	N50.39353	E14.0736	167	CZE	—	—	—	—	—	—
UP0088	U0210	PRC-439022	•	•	subsp. *dioica*	4	LR	N50.39478	E14.08373	167	CZE	965 836	952,933 (1.3)	934,797 (1.9)	710,450 (74.4)	878	10,6

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UP0090	U0212	PRC-439023		•	subsp. *subinermis*	2	LR	N50.17308	E14.85827	189	CZE	—	—	—	—	—	—
UP0091	U0213	PRC-439024		•	subsp. *subinermis*	2	LR	N50.1731	E14.85843	189	CZE	—	—	—	—	—	—
	U0214	PRC-439025	•	•	subsp. *dioica*	4	LR	N50.1731	E14.85843	189	CZE	1 412 878	1,331,037 (5.8)	1,314,811 (1.2)	842,841 (62.7)	962	10,1
UP0093	U0216	PRC-439026	•	•	subsp. *dioica*	4	LR	N50.32237	E14.46868	160	CZE	1 976 940	1,936,846 (2.0)	1,916,294 (1.1)	1,345,728 (68.5)	1 012	9,7
	U0217	PRC-439027		•	subsp. *dioica*	4	LR	N50.32237	E14.46868	160	CZE	—	—	—	—	—	—
UP0095	U0219	PRC-439028	•	•	subsp. *dioica*	4	LR	N50.41921	E14.13407	166	CZE	2 375 692	2,319,145 (2.4)	2,279,321 (1.7)	1,674,741 (70.9)	991	10,1
UP0101	U0225	PRC-439029		•	subsp. *dioica*	4	LR	N50.42683	E14.14666	166	CZE	—	—	—	—	—	—
UP0102	U0226	PRC-439030		•	subsp. *subinermis*	2	LR	N50.24703	E14.54956	2	CZE	—	—	—	—	—	—
UP0103	U0227	PRC-439087		•	subsp. *subinermis*	2	LR	N50.24606	E14.54842	2	CZE	—	—	—	—	—	—
UP0106	U0230	PRC-439088		•	subsp. *subinermis*	2	LR	N50.24169	E14.5485	2	CZE	—	—	—	—	—	—
UP0107	U0235	PRC-439089	•	•	subsp. *dioica*	4	JC	N47.40778	E25.51889	761	ROU	1 787 478	1,698,800 (5.0)	1,677,164 (1.3)	1,082,385 (63.4)	957	10,2
UP0108	U0236	PRC-438837	•	•	subsp. *dioica*	4	HD	N47.82103	E15.29414	790	AUT	2 080 170	2,001,476 (3.8)	1,981,864 (1.0)	1,359,638 (67.3)	1 007	9,9
UP0109	U0238	PRC-438838		•	subsp. *dioica*	4	FK	N54.18744	E15.64299	14	POL	—	—	—	—	—	—
UP0110	U0239	PRC-438839	•	•	subsp. *dioica*	4	EZ, FK	N55.4351	E13.91231	3	SWE	1 425 020	1,366,769 (4.1)	1,340,169 (2.0)	843,388 (61.9)	944	10,3
UP0111	U0241	PRC-438840	•	•	subsp. *dioica*	4	EZ, FK	N55.6575	E14.26973	38	SWE	1 454 364	1,398,086 (3.9)	1,373,630 (1.8)	879,633 (62.6)	962	9,7
UP0112	U0242	PRC-438841	•	•	subsp. *dioica*	4	FK	N54.46198	E18.561	11	POL	1 900 800	1,871,039 (1.6)	1,627,807 (13.0)	1,170,031 (70.4)	898	11,1
UP0114	U0252	PRC-438842	•	•	subsp. *dioica*	4	FK	N43.68972	E18.26778	1575	BIH	1 768 194	1,725,682 (2.4)	1,703,022 (1.3)	1,138,565 (65.7)	975	10,2
UP0116	U0260	PRC-438843		•	subsp. *pubescens*	2	LR	N46.1123	E13.1123	129	ITA	—	—	—	—	—	—
UP0132	U0311	—	•		subsp. *subinermis*	2	LR	N48.49647	E21.87483	99	SVK	1 566 076	1,534,063 (2.1)	1,479,395 (3.6)	1,290,785 (84.5)	916	10,8
UP0136	U0339	—	•		subsp. *dioica*	4	LR	N48.48475	E21.84961	98	SVK	2 067 616	2,019,248 (2.3)	1,973,544 (2.3)	1,648,530 (81.6)	951	11,2
UP0162	U0461	—	•		subsp. *dioica*	4	FK	N37.94089	E14.95978	1156	ITA	2 124 794	2,072,483 (2.5)	2,033,081 (1.9)	1,754,092 (84.0)	949	11,0
UP0187	U0485	—	•		subsp. *subinermis*	2	MD	N46.16592	E14.68781	327	SVN	1 308 382	1,282,002 (2.0)	1,235,754 (3.6)	1,104,113 (86.3)	893	10,9
UP0197	U0501	—	•		subsp. *dioica*	4	KN	N53.64978	W-9.88042	7	IRL	—	—	—	—	—	—
UP0204	U0559	—	•		subsp. *dioica*	4	TU	N40.10264	E29.12814	1930	TUR	1 423 368	1,384,958 (2.7)	1,356,846 (2.0)	1,165,681 (83.5)	917	10,8
UP0217	U2229	PRC-439060	•	•	subsp. *subinermis*	2	LR, SH	N56.95191	E23.51314	2	LVA	1 089 082	1,054,470 (3.2)	968,258 (8.2)	634,557 (64.0)	859	10,7
	U2230	PRC-439059		•	subsp. *subinermis*	2	LR, SH	N56.95191	E23.51314	2	LVA	—	—	—	—	—	—
	U2231	PRC-439058		•	subsp. *subinermis*	2	LR, SH	N56.95191	E23.51314	2	LVA	—	—	—	—	—	—
	U2232	PRC-439057		•	subsp. *subinermis*	2	LR, SH	N56.95191	E23.51314	2	LVA	—	—	—	—	—	—

ID number of population	ID number of analysis	ID number of voucher specimens	Molecular analysis	Morphometrics analysis	Taxon	DNA-ploidy level	Collector	Latitude (WGS-84)	Longitude (WGS-84)	Altitude (m a.s.l.)	Country (ISO 3166-1)	Total nr. reads	Nr. reads after quality filtering (% low quality)	Nr. reads without duplicates (% duplicates)	Nr. map. low-copy gene reads (% LCG reads)	No. mapped genes	Missing data LCG
	U2233	PRC-439056		•	subsp. *subinermis*	2	LR, SH	N56.95191	E23.51314	2	LVA	—	—	—	—	—	—
	U2234	PRC-439055		•	subsp. *subinermis*	2	LR, SH	N56.95191	E23.51314	2	LVA	—	—	—	—	—	—
	U2287	PRC-439048		•	subsp. *subinermis*	2	LR, SH	N56.95191	E23.51314	2	LVA	—	—	—	—	—	—
UP0224	U0626	PRC-438844	•	•	subsp. *dioica*	4	JC	N39.40366	E21.20857	1353	GRC	2 063 916	2,030,998 (1.6)	2,004,310 (1.3)	1,422,778 (69.4)	983	10,3
UP0337	U2896	PRC-438962	•	•	subsp. *dioica*	4	FK	N41.83395	E43.32967	934	GEO	1 212 044	1,185,782 (2.2)	1,148,688 (3.1)	1,013,865 (86.6)	882	10,9
UP0436	U1322	—	•		subsp. *sondenii*	2	FK	N69.67887	E18.8982	1	NOR	—	—	—	—	—	—
UP0447	U1369	—	•		subsp. *subinermis*	2	LR	N45.41522	E16.57194	91	HRV	1 275 048	1,245,036 (2.4)	1,207,978 (3.0)	1,058,123 (85.3)	901	10,8
UP0460	U1542	PRC-438845		•	subsp. *dioica*	4	AK, KS	N46.48827	E23.36598	901	ROU	—	—	—	—	—	—
	U1544	—	•		subsp. *dioica*	4	AK, KS	N46.48827	E23.36598	901	ROU	2 800 408	2,718,708 (2.9)	2,674,212 (1.6)	1,990,312 (72.3)	1 010	9,6
UP0463	U1574	—	•		subsp. *dioica*	4	EZ, FK	N36.9881	W-4.92534	422	ESP	1 759 730	1,722,957 (2.1)	1,688,441 (2.0)	1,445,636 (83.5)	946	11,2
UP0466	U1592	PRC-439185	•		subsp. *subinermis*	2	LR	N48.94444	E16.59044	183	CZE	—	—	—	—	—	—
UP0519	U1742	PRC-438846		•	subsp. *dioica*	4	JC, TU	N40.7898	E39.61565	451	TUR	—	—	—	—	—	—
	U1743	PRC-438847		•	subsp. *dioica*	4	JC, TU	N40.7898	E39.61565	451	TUR	—	—	—	—	—	—
	U1744	PRC-438884		•	subsp. *dioica*	4	JC, TU	N40.7898	E39.61565	451	TUR	—	—	—	—	—	—
	U1745	PRC-438885		•	subsp. *dioica*	4	JC, TU	N40.7898	E39.61565	451	TUR	—	—	—	—	—	—
	U1746	PRC-438886		•	subsp. *dioica*	4	JC, TU	N40.7898	E39.61565	451	TUR	—	—	—	—	—	—
UP0520	U1747	PRC-438887		•	subsp. *dioica*	4	JC, TU	N40.69418	E39.45818	1380	TUR	—	—	—	—	—	—
	U1749	PRC-438888		•	subsp. *dioica*	4	JC, TU	N40.69418	E39.45818	1380	TUR	—	—	—	—	—	—
	U1750	PRC-438889		•	subsp. *dioica*	4	JC, TU	N40.69418	E39.45818	1380	TUR	—	—	—	—	—	—
UP0521	U1752	PRC-438890		•	subsp. *dioica*	4	JC, TU	N40.6418	E39.40345	2060	TUR	—	—	—	—	—	—
	U1753	PRC-438891		•	subsp. *dioica*	4	JC, TU	N40.6418	E39.40345	2060	TUR	—	—	—	—	—	—
	U1755	PRC-438892		•	subsp. *dioica*	4	JC, TU	N40.6418	E39.40345	2060	TUR	—	—	—	—	—	—
UP0522	U1758	PRC-438893		•	subsp. *dioica*	4	JC, TU	N40.23224	E39.44778	1710	TUR	—	—	—	—	—	—
	U1759	PRC-438894		•	subsp. *dioica*	4	JC, TU	N40.23224	E39.44778	1710	TUR	—	—	—	—	—	—
UP0523	U1761	PRC-438895		•	subsp. *dioica*	4	JC, TU	N40.07921	E38.77463	1165	TUR	—	—	—	—	—	—
	U1762	PRC-438896		•	subsp. *dioica*	4	JC, TU	N40.07921	E38.77463	1165	TUR	—	—	—	—	—	—
	U1763	PRC-438897		•	subsp. *dioica*	4	JC, TU	N40.07921	E38.77463	1165	TUR	—	—	—	—	—	—
UP0524	U1765	PRC-438898	•	•	subsp. *dioica*	4	JC, TU	N39.8551	E38.39826	2080	TUR	2 406 774	2,301,885 (4.4)	2,280,983 (0.9)	1,708,882 (71.9)	1 015	9,9

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UP0525	U1767	PRC-438899		•	subsp. *kurdistanica*	2	JC, TU	N38.52032	E35.52553	2196	TUR	—	—	—	—	—	—
	U1768	PRC-438900	•	•	subsp. *kurdistanica*	2	JC, TU	N38.52032	E35.52553	2196	TUR	1 291 060	1,238,098 (4.1)	1,213,654 (2.0)	784,894 (63.2)	921	10,5
	U1769	PRC-438901		•	subsp. *kurdistanica*	2	JC, TU	N38.52032	E35.52553	2196	TUR	—	—	—	—	—	—
	U1770	PRC-438902		•	subsp. *kurdistanica*	2	JC, TU	N38.52032	E35.52553	2196	TUR	—	—	—	—	—	—
	U1771	PRC-438903		•	subsp. *kurdistanica*	2	JC, TU	N38.52032	E35.52553	2196	TUR	—	—	—	—	—	—
UP0526	U1772	PRC-438904		•	subsp. *kurdistanica*	2	JC, TU	N38.55548	E35.50371	2251	TUR	—	—	—	—	—	—
	U1773	PRC-438919		•	subsp. *kurdistanica*	2	JC, TU	N38.55548	E35.50371	2251	TUR	—	—	—	—	—	—
	U1774	PRC-438920		•	subsp. *kurdistanica*	2	JC, TU	N38.55548	E35.50371	2251	TUR	—	—	—	—	—	—
	U1775	PRC-438921		•	subsp. *kurdistanica*	2	JC, TU	N38.55548	E35.50371	2251	TUR	—	—	—	—	—	—
	U1776	PRC-438922		•	subsp. *kurdistanica*	2	JC, TU	N38.55548	E35.50371	2251	TUR	—	—	—	—	—	—
UP0527	U1777	PRC-438923	•	•	subsp. *kurdistanica*	2	JC, TU	N37.35832	E34.69034	1765	TUR	2 220 956	2,181,025 (1.8)	2,158,773 (1.0)	1,619,144 (72.6)	995	10,0
	U1778	PRC-438924		•	subsp. *kurdistanica*	2	JC, TU	N37.35832	E34.69034	1765	TUR	—	—	—	—	—	—
	U1779	PRC-438925		•	subsp. *kurdistanica*	2	JC, TU	N37.35832	E34.69034	1765	TUR	—	—	—	—	—	—
	U1781	PRC-438926		•	subsp. *kurdistanica*	2	JC, TU	N37.35832	E34.69034	1765	TUR	—	—	—	—	—	—
	U1782	PRC-438927		•	subsp. *kurdistanica*	2	JC, TU	N37.35832	E34.69034	1765	TUR	—	—	—	—	—	—
UP0528	U1783	PRC-438928		•	subsp. *subinermis*	2	JC, TU	N37.51418	E34.62849	1208	TUR	—	—	—	—	—	—
	U1784	PRC-438929		•	subsp. *subinermis*	2	JC, TU	N37.51418	E34.62849	1208	TUR	—	—	—	—	—	—
UP0529	U1786	PRC-438930		•	subsp. *subinermis*	2	JC, TU	N38.71923	E37.35649	1250	TUR	—	—	—	—	—	—
	U1788	PRC-438931		•	subsp. *subinermis*	2	JC, TU	N38.71923	E37.35649	1250	TUR	—	—	—	—	—	—
UP0530	U1790	PRC-438932	•	•	subsp. *dioica*	4	JC, TU	N39.01303	E40.70639	1195	TUR	167 570	163,914 (2.2)	160,892 (1.9)	109,488 (66.6)	748	14,1
	U1791	PRC-438933		•	subsp. *dioica*	4	JC, TU	N39.01303	E40.70639	1195	TUR	—	—	—	—	—	—
	U1792	PRC-438934		•	subsp. *dioica*	4	JC, TU	N39.01303	E40.70639	1195	TUR	—	—	—	—	—	—
UP0531	U1794	PRC-438935		•	subsp. *dioica*	4	JC, TU	N39.65896	E41.04833	2142	TUR	—	—	—	—	—	—
	U1795	PRC-438936		•	subsp. *dioica*	4	JC, TU	N39.65896	E41.04833	2142	TUR	—	—	—	—	—	—
	U1796	PRC-438937		•	subsp. *dioica*	4	JC, TU	N39.65896	E41.04833	2142	TUR	—	—	—	—	—	—
UP0532	U1797	PRC-438938		•	subsp. *dioica*	4	JC, TU	N40.11127	E40.98937	1938	TUR	—	—	—	—	—	—
UP0533	U1801	PRC-439191		•	subsp. *dioica*	4	JC, TU	N40.17477	E40.97288	2322	TUR	—	—	—	—	—	—
	U1802	PRC-439192		•	subsp. *dioica*	4	JC, TU	N40.17477	E40.97288	2322	TUR	—	—	—	—	—	—

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UP0534	U1803	PRC-439193		•	subsp. *dioica*	4	JC, TU	N40.34862	E40.78948	2380	TUR	—	—	—	—	—	—
UP0535	U1804	PRC-439194	•	•	subsp. *dioica*	4	JC, TU	N40.6225	E40.78063	2740	TUR	1 382 040	1,309,681 (5.2)	1,292,059 (1.4)	819,288 (62.4)	938	9,9
	U1805	PRC-439195		•	subsp. *dioica*	4	JC, TU	N40.6225	E40.78063	2740	TUR	—	—	—	—	—	—
	U1806	PRC-439196		•	subsp. *dioica*	4	JC, TU	N40.6225	E40.78063	2740	TUR	—	—	—	—	—	—
	U1807	PRC-439197		•	subsp. *dioica*	4	JC, TU	N40.6225	E40.78063	2740	TUR	—	—	—	—	—	—
UP0536	U1809	PRC-439198		•	subsp. *dioica*	4	JC, TU	N40.70466	E40.65491	1492	TUR	—	—	—	—	—	—
UP0537	U1811	PRC-439199		•	subsp. *dioica*	4	JC, TU	N40.75945	E40.59265	800	TUR	—	—	—	—	—	—
	U1812	PRC-439200		•	subsp. *dioica*	4	JC, TU	N40.75945	E40.59265	800	TUR	—	—	—	—	—	—
	U1813	PRC-439201		•	subsp. *dioica*	4	JC, TU	N40.75945	E40.59265	800	TUR	—	—	—	—	—	—
UP0538	U1814	PRC-439202	•	•	subsp. *dioica*	4	JC, TU	N40.98679	E40.33489	8	TUR	2 132 024	2,039,030 (4.4)	2,016,282 (1.1)	1,327,384 (64.6)	978	10,4
	U1815	PRC-439203		•	subsp. *dioica*	4	JC, TU	N40.98679	E40.33489	8	TUR	—	—	—	—	—	—
	U1816	PRC-439204		•	subsp. *dioica*	4	JC, TU	N40.98679	E40.33489	8	TUR	—	—	—	—	—	—
UP0551	U1877	PRC-439205		•	subsp. *dioica*	4	LR, SH	N59.02181	E14.59265	106	SWE	—	—	—	—	—	—
UP0554	U1891	PRC-439206		•	subsp. *dioica*	4	LR, SH	N60.82551	E14.12665	283	SWE	—	—	—	—	—	—
UP0558	U1915	PRC-439207	•	•	subsp. *dioica*	4	LR, SH	N61.84621	E14.0505	467	SWE	1 387 302	1,304,255 (6.0)	1,289,211 (1.2)	796,633 (60.3)	983	10,4
UP0561	U1928	PRC-429208	•	•	subsp. *dioica*	4	LR, SH	N62.7812	E14.43401	295	SWE	1 366 280	1,308,967 (4.2)	1,286,443 (1.7)	818,148 (62.0)	958	9,8
UP0564	U1949	PRC-439209		•	subsp. *dioica*	4	LR, SH	N63.19455	E15.13136	309	SWE	—	—	—	—	—	—
UP0566	U1960	PRC-439210		•	subsp. *dioica*	4	LR, SH	N63.14806	E17.76411	23	SWE	—	—	—	—	—	—
UP0578	U2029	PRC-439186	•		subsp. *dioica*	4	LR, SH	N66.45353	E22.39183	88	SWE	—	—	—	—	—	—
UP0580	U2040	PRC-439141	•	•	subsp. *sondenii*	2	LR, SH	N68.48526	E22.29748	328	FIN	1 682 666	1,626,529 (3.3)	1,599,013 (1.7)	1,088,781 (65.8)	971	10,0
	U2041	PRC-439114		•	subsp. *sondenii*	2	LR, SH	N68.48526	E22.29748	328	FIN	—	—	—	—	—	—
	U2042	PRC-439113		•	subsp. *sondenii*	2	LR, SH	N68.48526	E22.29748	328	FIN	—	—	—	—	—	—
	U2043	PRC-439112		•	subsp. *sondenii*	2	LR, SH	N68.48526	E22.29748	328	FIN	—	—	—	—	—	—
	U2044	PRC-439111		•	subsp. *sondenii*	2	LR, SH	N68.48526	E22.29748	328	FIN	—	—	—	—	—	—
UP0581	U2045	PRC-439110	•	•	subsp. *dioica*	4	LR, SH	N69.92744	E23.27426	13	NOR	1 427 574	1,376,763 (3.6)	1,356,223 (1.5)	841,290 (60.7)	948	9,7
UP0582	U2055	PRC-439109		•	subsp. *sondenii*	2	LR, SH	N70.51665	E25.07363	13	NOR	—	—	—	—	—	—
	U2056	PRC-439108		•	subsp. *sondenii*	2	LR, SH	N70.51665	E25.07363	13	NOR	—	—	—	—	—	—
	U2057	PRC-439107	•	•	subsp. *sondenii*	2	LR, SH	N70.51665	E25.07363	13	NOR	1 435 372	1,395,149 (2.8)	1,377,637 (1.3)	848,629 (59.6)	939	10,5

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	U2058	PRC-439106		•	subsp. *sondenii*	2	LR, SH	N70.51665	E25.07363	13	NOR	—	—	—	—	—	—
	U2059	PRC-439105	•	•	subsp. *sondenii*	2	LR, SH	N70.51665	E25.07363	13	NOR	2 337 004	2,266,891 (3.0)	2,175,169 (4.1)	1,781,474 (78.1)	964	10,9
	U2060	PRC-439104		•	subsp. *sondenii*	2	LR, SH	N70.51665	E25.07363	13	NOR	—	—	—	—	—	—
UP0583	U2062	PRC-439103		•	subsp. *sondenii*	2	LR, SH	N70.03428	E24.97239	47	NOR	—	—	—	—	—	—
	U2063	PRC-439102		•	subsp. *sondenii*	2	LR, SH	N70.03428	E24.97239	47	NOR	—	—	—	—	—	—
UP0584	U2071	PRC-439101		•	subsp. *sondenii*	2	LR, SH	N67.83978	E26.72058	182	FIN	—	—	—	—	—	—
	U2072	PRC-439086		•	subsp. *sondenii*	2	LR, SH	N67.83978	E26.72058	182	FIN	—	—	—	—	—	—
	U2073	PRC-439085		•	subsp. *sondenii*	2	LR, SH	N67.83978	E26.72058	182	FIN	—	—	—	—	—	—
	U2074	PRC-439084		•	subsp. *sondenii*	2	LR, SH	N67.83978	E26.72058	182	FIN	—	—	—	—	—	—
	U2075	PRC-439083		•	subsp. *sondenii*	2	LR, SH	N67.83978	E26.72058	182	FIN	—	—	—	—	—	—
	U2076	PRC-439082		•	subsp. *sondenii*	2	LR, SH	N67.83978	E26.72058	182	FIN	—	—	—	—	—	—
UP0585	U2077	PRC-439081		•	subsp. *dioica*	4	LR, SH	N66.53263	E25.7135	70	FIN	—	—	—	—	—	—
UP0587	U2086	PRC-439090	•	•	subsp. *dioica*	4	LR, SH	N65.32458	E25.37945	13	FIN	1 857 886	1,795,412 (3.4)	1,775,824 (1.1)	1,315,048 (72.6)	958	10,1
UP0593	U2122	PRC-439091		•	subsp. *subinermis*	2	LR, SH	N63.5949	E27.16149	93	FIN	—	—	—	—	—	—
	U2123	PRC-439092		•	subsp. *subinermis*	2	LR, SH	N63.5949	E27.16149	93	FIN	—	—	—	—	—	—
	U2124	PRC-439093		•	subsp. *subinermis*	2	LR, SH	N63.5949	E27.16149	93	FIN	—	—	—	—	—	—
	U2125	PRC-439094		•	subsp. *subinermis*	2	LR, SH	N63.5949	E27.16149	93	FIN	—	—	—	—	—	—
UP0594	U2126	PRC-439095		•	subsp. *subinermis*	2	LR, SH	N62.1609	E28.15618	91	FIN	—	—	—	—	—	—
	U2127	PRC-439096		•	subsp. *subinermis*	2	LR, SH	N62.1609	E28.15618	91	FIN	—	—	—	—	—	—
	U2128	PRC-439097		•	subsp. *subinermis*	2	LR, SH	N62.1609	E28.15618	91	FIN	—	—	—	—	—	—
	U2129	PRC-439098		•	subsp. *subinermis*	2	LR, SH	N62.1609	E28.15618	91	FIN	—	—	—	—	—	—
	U2130	PRC-439099		•	subsp. *subinermis*	2	LR, SH	N62.1609	E28.15618	91	FIN	—	—	—	—	—	—
	U2131	PRC-439100		•	subsp. *subinermis*	2	LR, SH	N62.1609	E28.15618	91	FIN	—	—	—	—	—	—
UP0596	U2135	PRC-439135	•	•	subsp. *subinermis*	2	LR, SH	N61.48451	E29.48244	88	FIN	1 961 140	1,909,684 (2.6)	1,888,020 (1.1)	1,355,103 (69.6)	976	9,7
	U2136	PRC-439136		•	subsp. *subinermis*	2	LR, SH	N61.48451	E29.48244	88	FIN	—	—	—	—	—	—
	U2137	PRC-439137		•	subsp. *subinermis*	2	LR, SH	N61.48451	E29.48244	88	FIN	—	—	—	—	—	—
	U2138	PRC-439138		•	subsp. *subinermis*	2	LR, SH	N61.48451	E29.48244	88	FIN	—	—	—	—	—	—
	U2139	PRC-439139		•	subsp. *subinermis*	2	LR, SH	N61.48451	E29.48244	88	FIN	—	—	—	—	—	—

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UP0597	U2140	PRC-439140		•	subsp. *subinermis*	2	LR, SH	N61.86335	E29.28756	74	FIN	—	—	—	—	—	—
	U2141	PRC-439080		•	subsp. *subinermis*	2	LR, SH	N61.86335	E29.28756	74	FIN	—	—	—	—	—	—
	U2142	PRC-439079		•	subsp. *subinermis*	2	LR, SH	N61.86335	E29.28756	74	FIN	—	—	—	—	—	—
	U2143	PRC-439078		•	subsp. *subinermis*	2	LR, SH	N61.86335	E29.28756	74	FIN	—	—	—	—	—	—
	U2144	PRC-439077		•	subsp. *subinermis*	2	LR, SH	N61.86335	E29.28756	74	FIN	—	—	—	—	—	—
UP0599	U2148	PRC-439076	•	•	subsp. *subinermis*	2	LR, SH	N62.39703	E26.42971	99	FIN	580 296	572,014 (1.4)	566,388 (1.0)	386,720 (66.9)	876	10,6
	U2149	PRC-439075		•	subsp. *subinermis*	2	LR, SH	N62.39703	E26.42971	99	FIN	—	—	—	—	—	—
	U2150	PRC-439074		•	subsp. *subinermis*	2	LR, SH	N62.39703	E26.42971	99	FIN	—	—	—	—	—	—
UP0600	U2151	PRC-439073		•	subsp. *subinermis*	2	LR, SH	N62.90926	E24.82408	150	FIN	—	—	—	—	—	—
	U2152	PRC-439072		•	subsp. *subinermis*	2	LR, SH	N62.90926	E24.82408	150	FIN	—	—	—	—	—	—
	U2153	PRC-439071		•	subsp. *subinermis*	2	LR, SH	N62.90926	E24.82408	150	FIN	—	—	—	—	—	—
UP0603	U2165	PRC-439070		•	subsp. *dioica*	4	LR, SH	N62.9715	E21.4927	4	FIN	—	—	—	—	—	—
UP0606	U2178	PRC-439069		•	subsp. *dioica*	4	LR, SH	N61.56547	E21.68465	1	FIN	—	—	—	—	—	—
UP0608	U2189	PRC-439068		•	subsp. *dioica*	4	LR, SH	N60.23938	E24.65983	19	FIN	—	—	—	—	—	—
UP0611	U2202	PRC-439067		•	subsp. *dioica*	4	LR, SH	N59.23143	E24.7117	55	EST	—	—	—	—	—	—
UP0616	U2224	PRC-439065	•	•	subsp. *dioica*	4	LR, SH	N57.98581	E26.04486	71	EST	782 674	760,021 (2.9)	696,751 (8.3)	466,804 (65.8)	868	10,7
	U2225	PRC-439064		•	subsp. *dioica*	4	LR, SH	N57.98581	E26.04486	71	EST	—	—	—	—	—	—
	U2226	PRC-439063		•	subsp. *dioica*	4	LR, SH	N57.98581	E26.04486	71	EST	—	—	—	—	—	—
	U2227	PRC-439062		•	subsp. *dioica*	4	LR, SH	N57.98581	E26.04486	71	EST	—	—	—	—	—	—
	U2228	PRC-439061		•	subsp. *dioica*	4	LR, SH	N57.98581	E26.04486	71	EST	—	—	—	—	—	—
UP0620	U2249	PRC-439054	•		subsp. *dioica*	4	LR, SH	N54.64675	E24.93551	156	LTU	705 606	677,904 (3.9)	631,136 (6.9)	399,594 (62.3)	859	10,9
UP0621	U2264	PRC-439052	•	•	subsp. *dioica*	4	PV, TU	N51.10167	E17.0715	132	POL	744 996	725,508 (2.6)	665,542 (8.3)	449,923 (66.1)	850	10,3
UP0626	U2282	PRC-439051	•	•	subsp. *subinermis*	2	PV, TU	N52.48602	E12.83499	29	DEU	788 142	768,159 (2.5)	703,737 (8.4)	460,497 (63.6)	848	10,3
UP0627	U2285	PRC-439050	•	•	subsp. *subinermis*	2	PV, TU	N52.48055	E12.80989	29	DEU	1 945 364	1,889,234 (2.9)	1,849,638 (2.1)	1,314,189 (69.0)	959	10,3
	U2286	PRC-439049	•	•	subsp. *dioica*	4	PV, TU	N52.48055	E12.80989	29	DEU	2 203 810	2,132,020 (3.3)	2,108,336 (1.1)	1,550,696 (71.8)	987	10,2
UP0634	U2367	PRC-439047		•	subsp. *pubescens*	2	LR	N44.9477	E12.26107	1	ITA	—	—	—	—	—	—
	U2368	PRC-439046		•	subsp. *pubescens*	2	LR	N44.9477	E12.26107	1	ITA	—	—	—	—	—	—
	U2369	PRC-439045		•	subsp. *pubescens*	2	LR	N44.9477	E12.26107	1	ITA	—	—	—	—	—	—

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	U2370	PRC-439044		•	subsp. *pubescens*	2	LR	N44.9477	E12.26107	1	ITA	—	—	—	—	—	—
	U2371	PRC-439043		•	subsp. *dioica*	4	LR	N44.9477	E12.26107	1	ITA	—	—	—	—	—	—
UP0649	U2431	PRC-439042	•	•	subsp. *dioica*	4	LR	N46.3112	E10.7739	951	ITA	2 878 762	2,816,802 (2.2)	2,562,756 (9.0)	1,768,555 (67.0)	967	11,2
UP0652	U2439	PRC-439041		•	subsp. *dioica*	4	LR	N46.613	E10.58228	935	ITA	—	—	—	—	—	—
	U2440	PRC-439040		•	subsp. *dioica*	4	LR	N46.613	E10.58228	935	ITA	—	—	—	—	—	—
	U2441	PRC-439039		•	subsp. *pubescens*	2	LR	N46.613	E10.58228	935	ITA	—	—	—	—	—	—
	U2442	PRC-439038		•	subsp. *dioica*	4	LR	N46.613	E10.58228	935	ITA	—	—	—	—	—	—
	U2443	PRC-439037		•	subsp. *pubescens*	2	LR	N46.613	E10.58228	935	ITA	—	—	—	—	—	—
UP0654	U2452	PRC-439036	•	•	subsp. *pubescens*	2	LR	N46.2365	E10.22507	530	ITA	547 346	540,290 (1.3)	533,302 (1.3)	383,309 (68.9)	828	10,7
UP0658	U2468	PRC-439035		•	subsp. *pubescens*	2	LR	N45.78667	E8.92007	411	ITA	—	—	—	—	—	—
	U2469	PRC-439034		•	subsp. *dioica*	4	LR	N45.78667	E8.92007	411	ITA	—	—	—	—	—	—
	U2470	PRC-439033	•	•	subsp. *pubescens*	2	LR	N45.78667	E8.92007	411	ITA	3 222 802	3,125,224 (3.0)	2,848,110 (8.9)	2,257,734 (76.3)	981	11,2
	U2471	PRC-439032	•	•	subsp. *dioica*	4	LR	N45.78667	E8.92007	411	ITA	3 488 918	3,433,380 (1.6)	3,103,730 (9.6)	2,450,383 (75.8)	967	10,9
UP0670	U2521	PRC-439031	•	•	subsp. *pubescens*	2	LR	N44.34772	E8.20962	451	ITA	2 546 860	2,481,426 (2.6)	2,292,092 (7.6)	1,715,742 (72.6)	950	10,7
UP0674	U2536	PRC-439015		•	subsp. *dioica*	4	LR	N45.0497	E8.62982	86	ITA	—	—	—	—	—	—
	U2537	PRC-439016		•	subsp. *pubescens*	2	LR	N45.0497	E8.62982	86	ITA	—	—	—	—	—	—
	U2538	PRC-439014		•	subsp. *pubescens*	2	LR	N45.0497	E8.62982	86	ITA	—	—	—	—	—	—
	U2539	PRC-439013		•	subsp. *pubescens*	2	LR	N45.0497	E8.62982	86	ITA	—	—	—	—	—	—
UP0680	U2563	PRC-439012	•	•	subsp. *pubescens*	2	LR	N44.65102	E9.8108	349	ITA	2 510 028	2,463,147 (1.9)	2,237,263 (9.2)	1,654,002 (72.0)	964	12,0
UP0683	U2572	PRC-439011	•	•	subsp. *pubescens*	2	LR	N44.9067	E10.51723	14	ITA	2 567 316	2,521,371 (1.8)	2,283,139 (9.5)	1,703,256 (72.8)	957	11,5
	U2574	PRC-439010		•	subsp. *pubescens*	2	LR	N44.9067	E10.51723	14	ITA	—	—	—	—	—	—
UP0685	U2583	PRC-438974	•	•	subsp. *dioica*	4	LR	N45.93151	E6.91746	1916	FRA	3 205 518	3,153,299 (1.6)	2,830,863 (10.2)	2,148,476 (74.0)	969	12,1
UP0687	U2589	—	•		subsp. *subinermis*	2	LR	N48.22525	E17.21138	140	SVK	2 469 972	2,405,039 (2.6)	2,197,775 (8.6)	1,655,220 (73.0)	942	11,4
UP0688	U2599	PRC-438973	•		*U. kioviensis*	X	LR	N48.2433	E17.25355	134	SVK	1 556 944	1,514,572 (2.7)	1,394,558 (7.9)	884,993 (62.4)	920	11,3
UP0694	U2617	PRC-438972	•	•	subsp. *subinermis*	2	LR	N47.77967	E18.13973	102	SVK	719 108	706,989 (1.7)	693,115 (2.0)	506,090 (71.5)	871	10,8
UP0710	U2698	PRC-438971	•	•	subsp. *dioica*	4	TU, PV, RU	N37.57083	E48.6763	2273	IRN	3 217 516	3,149,348 (2.1)	3,079,322 (2.2)	2,621,631 (82.9)	957	11,4
UP0719	U2728	PRC-438970	•	•	subsp. *dioica*	4	TU, PV, RU	N35.80882	E52.28233	2968	IRN	3 030 192	2,973,947 (1.9)	2,922,989 (1.7)	2,180,663 (73.3)	1 019	11,5
UP0720	U2734	PRC-438969		•	subsp. *dioica*	4	TU, PV, RU	N36.20252	E51.92603	1925	IRN	—	—	—	—	—	—

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UP0721	U2738	PRC-438968	•	•	subsp. *dioica*	4	TU, PV, RU	N36.23832	E51.43928	3140	IRN	1 631 718	1,591,578 (2.5)	1,547,418 (2.8)	1,321,774 (83.7)	938	10,9
UP0725	U2751	PRC-438967	•		subsp. *dioica*	4	TU, RU	N41.19679	E22.77564	146	GRC	915 422	902,785 (1.4)	891,785 (1.2)	665,908 (73.0)	901	11,0
UP0726	U2767	PRC-438966	•	•	subsp. *subinermis*	2	TU, RU	N41.44564	E23.27741	86	BGR	1 057 618	1,045,650 (1.1)	1,026,694 (1.8)	779,152 (74.5)	894	11,1
UP0771	U2905	PRC-438961		•	subsp. *dioica*	4	FK	N41.66	E43.65279	2000	GEO	—	—	—	—	—	—
UP0772	U2917	PRC-438946		•	subsp. *subinermis*	2	TU	N42.80928	E9.48922	7	FRA	—	—	—	—	—	—
UP0778	U2931	PRC-438944		•	subsp. *subinermis*	2	LR	N48.77615	E12.9396	331	DEU	—	—	—	—	—	—
UP0779	U2939	PRC-438943	•	•	subsp. *dioica*	4	LR	N48.98442	E12.44242	331	DEU	2 054 728	2,004,409 (2.5)	1,964,199 (2.0)	1,697,101 (84.3)	963	11,4
UP0784	U2964	PRC-438942		•	subsp. *subinermis*	2	LR	N49.81522	E8.45752	94	DEU	—	—	—	—	—	—
	U2967	PRC-438941	•	•	subsp. *dioica*	4	LR	N49.81522	E8.45752	94	DEU	1 445 056	1,410,682 (2.4)	1,379,026 (2.3)	1,194,799 (84.6)	919	11,4
UP0786	U2979	PRC-438940		•	subsp. *subinermis*	2	TU	N48.84767	E16.72642	160	CZE	—	—	—	—	—	—
UP1219	U1729	PRC-438714	•		*U. cypria*	X	PT, ZC	N34.93594	E33.02818	1077	CYP	—	—	—	—	—	—
	U1731	PRC-438716	•		*U. cypria*	X	PT, ZC	N34.93594	E33.02818	1077	CYP	1 843 054	1,762,058 (4.4)	1,728,930 (1.9)	1,524,026 (77.5)	930	11,7
UP1230	U1827	PRC-440865		•	subsp. *dioica*	4	LR, SH	N55.6754	E13.33463	66	SWE	—	—	—	—	—	—
UP1234	U2206	PRC-439066	•		subsp. *dioica*	4	LR, SH	N59.38068	E27.5539	1	EST	1 764 488	1,721,216 (2.5)	1,686,610 (2.0)	1,422,918 (82.5)	939	11,2
UP1242	U1984	PRC-439211		•	subsp. *dioica*	4	LR, SH	N65.3779	E21.29759	24	SWE	—	—	—	—	—	—
UP1244	U2035	PRC-439212	•	•	subsp. *dioica*	4	LR, SH	N68.43923	E22.46148	313	SWE	2 021 036	1,920,400 (5.0)	1,901,322 (1.0)	1,294,169 (66.2)	988	10,0
UP1251	U0518	—	•		*U. pilulifera*	X	TU	N39.82822	E26.32177	45	TUR	693 870	675,322 (2.7)	665,556 (1.5)	382,871 (57.1)	578	20,9
UP1252	U2774	PRC-438965	•		*U. membranacea*	X	JP, ZK, JH	N40.28928	E9.49619	107	ITA	1 074 142	1,054,322 (1.9)	1,033,800 (2.0)	652,742 (62.7)	826	14,4
UP1253	U2831	—	•		*Cannabis ruderalis*	X	TU, RU	N47.64449	E17.59997	116	HUN	345 508	337,817 (2.2)	333,549 (1.3)	80,451 (24.0)	43	32,4
UP1254	U3035	PRC-438939	•		*U. gracilis*	X	MC	N43.38625	W-80.35175	205	CA	1 432 458	1,393,177 (2.8)	1,366,943 (1.9)	1,135,853 (81.6)	934	11,3
UP1255	U2875	PRC-438963	•		*U. urens*	X	LR	N50.07559	E14.41923	208	CZE	2 002 130	1,945,260 (2.9)	1,910,448 (1.8)	1,181,485 (61.5)	812	16,3
UP1256	U2257	PRC-439053	•	•	subsp. *dioica*	4	JC	N47.1124	E13.42765	1360	AUT	444 722	439,318 (1.2)	434,916 (1.0)	320,222 (72.2)	843	10,6
UP1257	U1682	PRC-439142	•		subsp. *dioica*	4	LR	N48.94659	E16.59772	181	CZE	—	—	—	—	—	—
UP1259	U2779	PRC-438964	•		*U. atrovirens*	X	JP, ZK, JH	N39.35427	E9.55250	8	ITA	742 272	733,543 (1.2)	719,577 (1.9)	501,441 (68.8)	837	11,2
UP1260	U2920	PRC-438945	•		*U. atrovirens*	X	TU, RU	N42.30477	E9.15027	460	FRA	1 453 136	1,419,177 (2.3)	1,386,641 (2.3)	1,129,014 (80.0)	920	11,6

Collectors: AK – Adam Knotek, EZ – Eliška Záveská, FK – Filip Kolář, HD – Hana Daneck, JC – Jindřich Chrtek, JH – Johana Hanzlíčková, JPR – Jan Prančl, KN – Klára Nunvářová, KS – Kristýna Šemberová, LR – Ludmila Rejlová, MC – Martin Čertner, MD – Martin Dudáš, PT – Pavel Trávníček, PV – Petr Vít, RU – Romana Urfusová, SH – Šárka Hořčicová, TU - Tomáš Urfus, ZC – Zuzana Chumová, ZK – Zdeněk Kaplan.* The voucher specimens are deposited in the Herbarium of the Charles University, Prague (PRC).

CASE STUDY III

Close, yet so distant: Diversification and island colonization in the genus *Urtica* (Urticaceae) in the Mediterranean biodiversity hotspot

Rejlová L. (unpublished review)

Close, yet so distant: Diversification and island colonization in the genus *Urtica* (Urticaceae) in the Mediterranean biodiversity hotspot

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Abstract

The ability to move is usually associated with animals rather than plants. However, if we look at the definition of movement, it is not just the act of movement itself, but also the power developed to transfer from one place to another. In the case of sessile organisms such as plants, this is mainly movement in the sense of dispersal of propagules. Whether it is either the development of active energy for transmission or passive transmission via a vector, it is an essential component of life-history traits that primarily affects efficient gene flow. Most of the dispersal events take place at a local scale and can be monitored. In the case of long-distance dispersal (LDD), direct observation or modeling is very difficult or even impossible, but with the help of phylogenetic reconstructions, these events can be mapped retrospect, which can shed light on island colonization or Holocene migration. Long-distance dispersal events are a phenomenon with an uncertain outcome, and it is depending also on the germination capacity and the ability of an individual to adapt to a new environment. This can be used to study the processes of global biogeography, the response of organisms to global climate change, gene flow in metapopulation dynamics, or the invasion potential of plants. One of the model examples with a relatively large number of island endemics is the genus *Urtica*, of which almost half the island endemics can be found in the Mediterranean biodiversity hotspot, which is one of the richest places in Europe for nettles with distinct diversity. At least two colonizations have been recorded for most of the islands, which is in accordance with the number of recorded LDD events within the Urticaceae family (≥ 92 LDD detected events, with ca 76 of them likely associated with transmission across at least one ocean). Despite the Mediterranean Basin being one of the most studied places and the distribution of *Urtica* endemic taxa having been mapped in detail, some nodes of phylogeny remain unclear. Based on latest phylogenetics research, combined with additional data such as genome size, support has been established for the separated position of *U. cypria*. Genome size has been shown to contribute to determination among other Mediterranean endemic species of *Urtica*.

Keywords: biodiversity hotspot, endemic, island, long-distance dispersal (LDD), Mediterranean, *Urtica*

The European Mediterranean biodiversity hotspot (i.e., Mediterranean Basin along with Macaronesia region; Fig. 1; Myers *et al.* 2000) is one of the 36 most important biodiversity centers in the world with a high percentage of range-restricted species (Myers *et al.* 2000, Médail & Myers 2004, Médail 2021). The specificity of the hotspot (i.e., in all other references the term "hotspot" is always intended as a biodiversity hotspot) is formed by the action of a number of factors such as biogeography (extends over 3 continents; diversity of habitats; center of migration routes; Blondel *et al.* 2010, Médail 2021), bioclimatic conditions (stability of climatic conditions; increasing aridity from west to east; Cowling *et al.* 2004, Lionello *et al.* 2006), palaeogeographic events (Messinian salinity crisis; almost unaffected by Quaternary climatic changes; Krijgsman *et al.* 1999, Médail & Diadema 2009, Roveri *et al.* 2014), geology (numerous seismic activities with accompanying phenomena; Jimenez *et al.* 2003, Roveri *et al.* 2014) or geomorphology (high number of islands of different origin and size; Médail 2021). Last but not least, the impact of human activity is an important driver, because the European Mediterranean belongs to the longest-inhabited areas in the world (profound impact of intensive slash-and-burn, logging, grazing and ploughing; Blondel 2008, Médail 2017, 2021). Initially, the area was mostly covered by evergreen sclerophyll forests, but due to man-driven changes and other influences (e.g., climatic changes), only 4.7% of the native vegetation cover remains (Myers *et al.* 2000, Suc *et al.* 2018, Sabatini *et al.* 2021). Nowadays, shrub formations (such as garrigue, macchia) and grassland dominate (Suc 1984, Jalut *et al.* 2009, Woodbridge *et al.* 2018). Mediterranean climate and vegetation can only be found in 4 other hotspots around the world (i.e., California, central Chile, the Cape, and Southwest Australia; Fig. 2), which represents only 0.3% of land surface (all the world's hotspots cover 1.4% of the Earth's surface; Myers 1990, Myers *et al.* 2000, Mittermeier *et al.* 2004, Rundel *et al.* 2016). The areas are primarily characterized by a stable climate (warm and dry summers, wet and moderate winters with a sufficient amount of precipitation), which enable two annual peaks of vegetation growth (one major in spring, one minor in the autumn). Another common characteristics is the geographic location, since all of these areas lie between the 30th–45th parallel, with a west- or southwest-exposed coastline washed by cold ocean currents (Fig. 2; Joffre & Rambal 2002, Rundel *et al.* 2016).

The Mediterranean Basin (delimited by the cultivation of *Olea europaea* subsp. *europaea*, corresponding to the native occurrence of *Quercus ilex* L.; Fig. 1; Cauldullo *et al.* 2017) itself is the third richest place in the number of plant endemics in the world (after the tropical Andes and Sundaland). Overall, about 10% of all known species of vascular plants (about 25,000 species) can be found here, of which 4.3% (approximately 13,000 plant species out of a total ca 300,000 plants worldwide) are endemic taxa (Myers *et al.* 2000). Compared to the rest of the European continent, the Mediterranean Basin comprises 80% of all European plant endemics (Comes 2004, Araújo 2005). The high level of endemism in the Mediterranean region is linked to several main phenomena. One of them is the high number of islands of different sizes. The area contains more than 11,000 islands ranging in size from around 25,000 km^2 to small islands of a few square kilometers, which provide a range of habitats from high altitude volcanic environments such as Etna at more than 3300 m a.s.l. to small islands with almost only littoral vegetation. The high number of islands may also form an important migration element in LDD events (Médail & Vidal 1998, Médail 2021). Another factor is the formation of glacial refugia in the Quaternary period (overall 52 refugia were identified in the Mediterranean Basin based on phylogeographical analyses of 82 plant species; Médail & Diadema 2009, Stewart *et al.* 2010, Médail 2017). These glacial refugia facilitated the survival of animal and plant species of different ages and also played a significant role in postglacial recolonizations (Taberlet 1998, Hewitt 1999, Petit *et al.* 2002, Schmitt & Varga 2012).

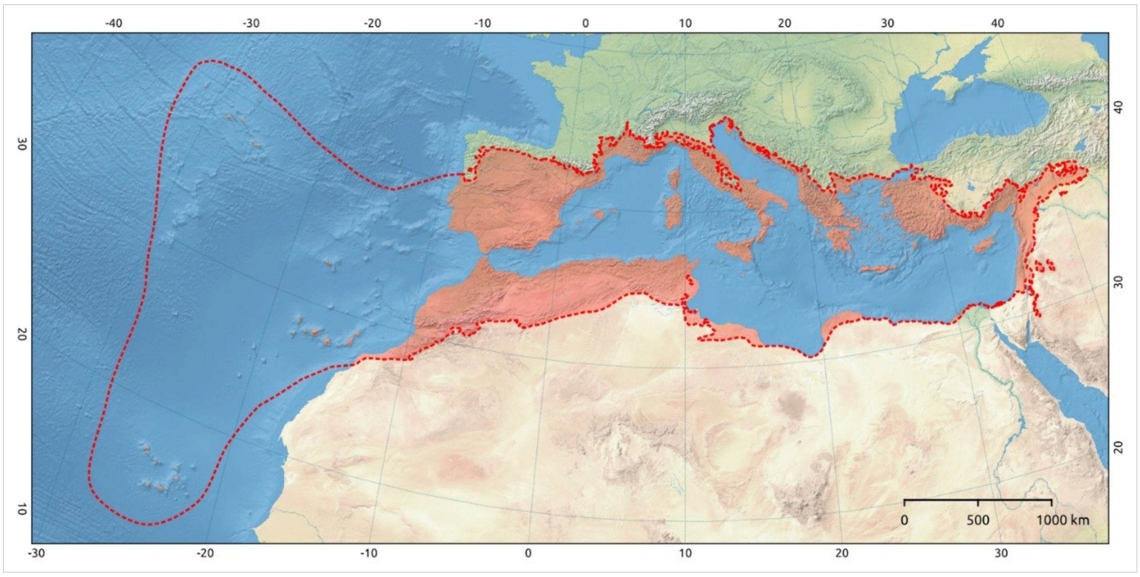

Figure 1. The Mediterranean hotspot. Delimitation of Mediterranean Basin (fully-colored red area) along with Macaronesia region, belonging to the Mediterranean hotspot (red dashed line; **data source**: Conservation Synthesis, Center for Applied Biodiversity Science at Conservation International 2011, Natural Earth – free vector and raster map data).

The degree of island endemism, along with the specificity of Mediterranean region, is a significant factor in shaping the genus *Urtica*. Although it is a relatively moderate-sized genus, it has a significant proportion of island endemics, almost half of which fall within the Mediterranean hotspot (Grosse-Veldmann *et al.* 2016). Taking into consideration the history of the islands with endemic *Urtica* species (discussed below), the estimated time of the disjunction of the most basal branch and the specificity of the whole region, the Mediterranean Basin is an important part in the evolution of nettles. Recent phylogenetic studies (Wu *et al.* 2018; Huang *et al.* 2019) suggested the probable origin of the genus *Urtica* in the Mediterranean. Phylogenies including most of the recognized species have identified *Urtica pilulifera* (estimated age 26.2 Mya-up to the present) as the most basal species of the whole genus. Its native occurrence is roughly in the whole Mediterranean area with overlap to adjacent regions of Middle East (POWO 2022). It is a widely distributed species throughout the whole area, which may have led to a wide differentiation (data with distribution records in Mediterranean hotspot and its vicinity in Fig. 3).

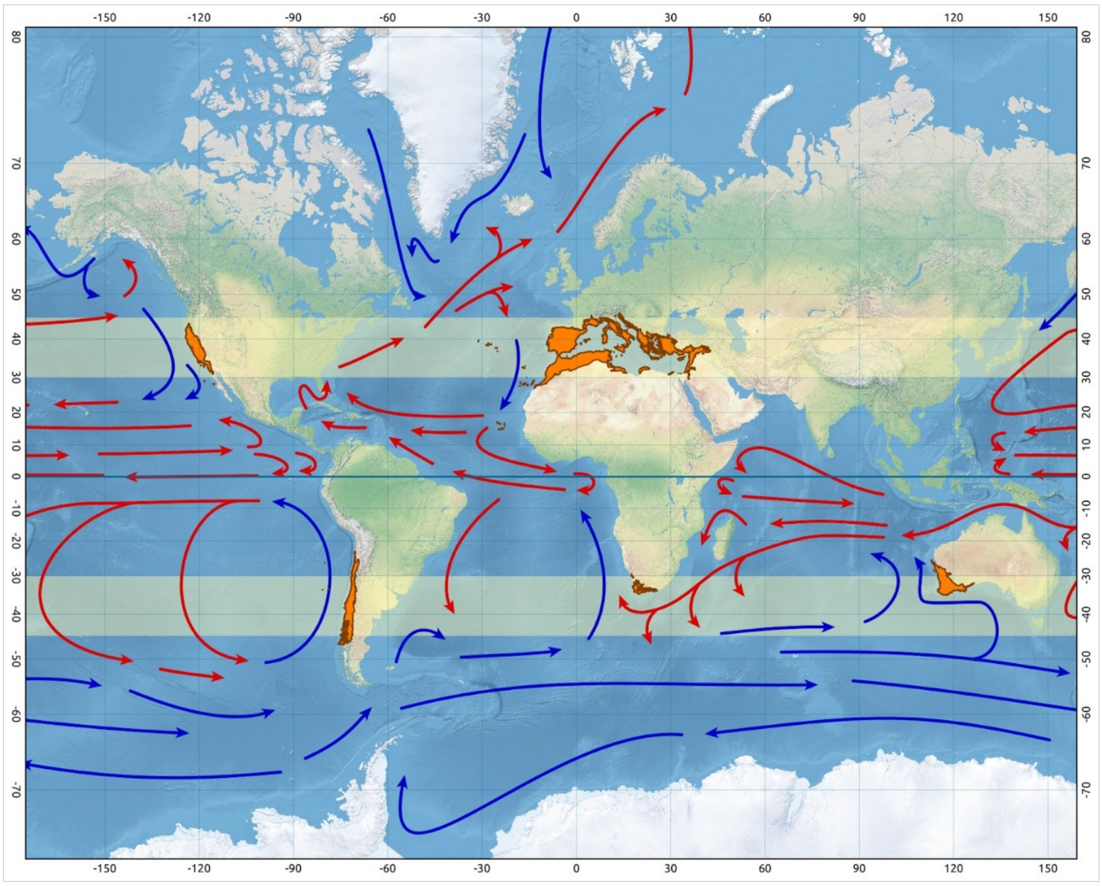

Figure 2. Map of world hotspots with Mediterranean climate and vegetation along with the world's major ocean currents. The blue arrows = cold currents, red arrows = warm currents (**data source**: ESRI – Environmental systems research institute, Conservation Synthesis, Center for Applied Biodiversity Science at Conservation International 2011, Natural Earth – Free vector and raster map data).

History of the Mediterranean islands with the *Urtica* endemics

As mentioned above, a high number of islands can be found in the Mediterranean hotspot, many of them completely isolated from the mainland, which is one of the conditions for the speciation processes underlying the high level of endemism (Vargas *et al*. 2018, Médail *et al* 2021). However, in the history of the Mediterranean and the islands themselves, we can encounter transitional periods, when a number of islands were temporarily connected to the mainland by so-called land bridges, which significantly influenced the development of the local fauna and flora (Médail 2017, Médail *et al.* 2021). In terms of geomorphology, we divide islands into two primary categories. 'Oceanic' islands were formed de novo by the movement of the Earth's plates or volcanic activity (followed by colonization of new flora and fauna), while 'continental' islands were part of the mainland or continental shelf with subsequent disconnection. Within the Mediterranean, the former category includes small volcanic islands (see Médail *et al.* 2021) and Cyprus, which was formed by the collision of lithospheric plates (the Anatolian and the African plate) and the subsequent uplift of the seabed. By dating of Troodos massif (Cyprus), which is one of the best preserved on-land sections of oceanic crust, the formation was dated between 90–92 Mya with subsequent later development (Mukasa & Ludden 1987, Lagroix & Borradaile 2000, Osozawa *et al.* 2012, Morag *et al.* 2016). The only brief connection of Cyprus with the mainland is assumed to be during the Late Miocene (5.3–7.3 Mya; Poulakakis *et al.* 2013). Evidence for colonization of this island by LDD events is provided by biogeographical affinities to Anatolia and Lebanon as evidenced by some plants of the African-Arabian element (such as *Lycium schweinfurthii* Dammer, *Prosopis farcta* (Banks & Sol.) J. F. Macbr., *Pteranthus dichotomus* Forssk., *Zygophyllum album* L. f.; Meikle 1985, Christofides 2017, Médail 2021, Poulakakis *et al.* 2013). Cyprus is also one of the few islands with the earliest documented human colonization. The settlement of the island has been dated to approximately 12,500–10,600 years ago, which was the end of the final part of hunter-gatherer cultures during the Mesolithic period. Influence of man may have had a significant impact on the development and composition of its flora and fauna (Vigne *et al.* 2012, Paulakakis *et al.* 2013, Zazzo *et al.* 2015). The 'oceanic' group also includes all the islands of Macaronesia that are all of volcanic origin, but of different ages (Lanzarote and Fuerteventura ca 20.2 Mya, Gran Canaria ca 14.6 Mya, Tenerife ca 11.9 Mya: La Gomera ca 9.4 Mya, La Palma ca 1.7 Mya, El Hierro ca 1.1 Mya). These islands have never been part of the mainland or even temporarily connected to it (Carracedo & Troll 2021, Anguita & Hernán 2000). However, multiple back-colonization events between Macaronesia and the Mediterranean have been recorded, such as in the case of the genus *Convolvulus* L. (Carine *et al.* 2004). Other Mediterranean islands with the *Urtica* endemics fall into the second category of 'continental' islands, which were connected to the mainland either directly or via the continental shelf. Here, a combination of tectonic and glacio-eustatic processes led to the separation of the islands. This is the case in the eastern Balearic Islands (Menorca and Mallorca), Corsica, Sardinia, and a part of Sicily (Peloritani Mountains), which were formerly part of the so-called Catalan-Corsican-Sardinian massif (also known as the Protoligurian massif; Alvarez 1976). The massif was located in the west Mediterranean Hercynian formation, which was fragmented in the mid-Tertiary period, causing the migration and rotation of the Corsica-Sardinia block (23–16 Mya; Alvarez *et al.* 1974, Alvarez 1976, Carminati *et al.* 1998, Rosenbaum *et al.* 2002, Speranza *et al.* 2002, Mansion *et al*. 2008, Soldati & Marchetti 2017). The ancient connection of these areas is also indicated by the occurrence of relict Tertiary plant species, e.g., *Arenaria balearica* L., *Helicodiceros muscivorus* (L. f.) Engl. (Mansion *et al.* 2008, Bobo-Pinilla *et al.* 2016). A special case is Sicily, where most of the island was underwater during the lower Pliocene (ca 5.3–3.6 Mya), with the exception of two areas, Peloritani Mts. and Hyblaean Plateau. Notably, two of the three Sicilian localities of the endemic species *U. rupestris* are in the Hyblaean Plateau see Fig. 3. Sicily also formed an important migratory element (especially between Africa and Europe via shallow seafloors in the surroundings of the Strait of Sicily) due to its almost continuous connections with the mainland (e.g., during the period of sea-level decrease during the Würm glaciation; Catalano *et al.* 2013, Civile *et al.* 2015, Di Maggio *et al.* 2017, Soldati & Marchetti 2017, Guarino & Pasta 2018, Rapisarda 2019, Gauchery *et al.* 2020, Schmitt *et al.* 2021).

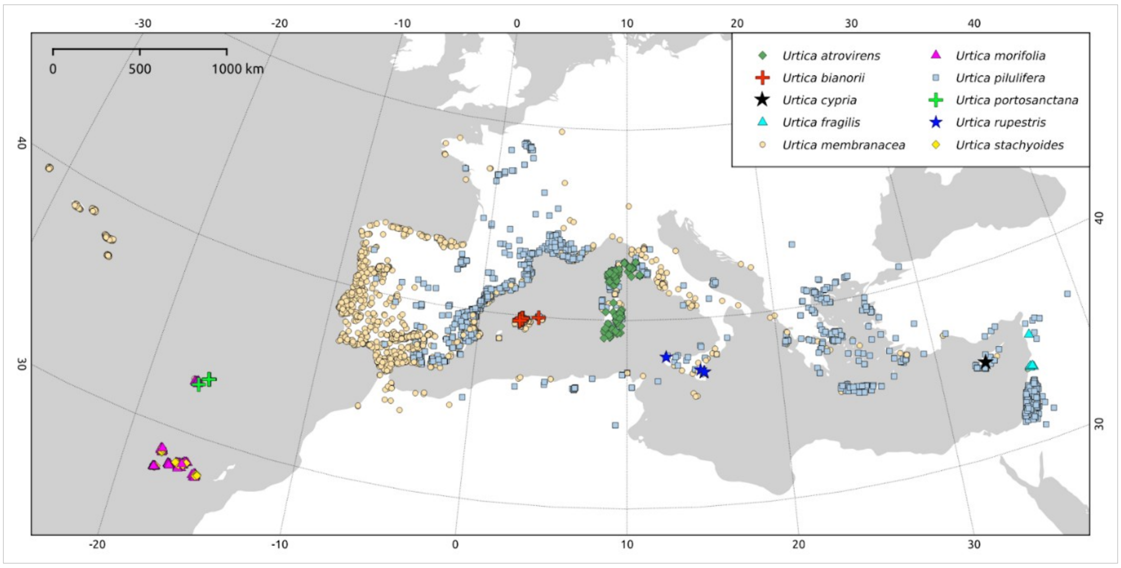

Figure 3. Distribution of the Mediterranean *Urtica* species in the area of the Mediterranean hotspot and its vicinity. Green diamonds = *Urtica atrovirens*, red crosses = *U. bianorii*; black star = *U. cypria*; cyan triangles = *U. fragilis*, beige circles = *U. membranacea*, magenta triangles = *U. morifolia*, light green crosses = *U. portosanctana*, light blue squares = *U. pilulifera*, blue stars = *U. rupestris*; yellow diamonds = *U. stachyoides* (**data source**: Natural Earth – Free vector and raster map data, GBIF 2022).

Factors affecting dispersal and successful colonization

Distance dispersal of propagules

In general, for angiosperms, as sessile organisms, dispersal through the movement of propagules (parts of plants, i.e., seeds, spores, vegetative stolons, used for propagation and reproduction) plays a crucial role. Apart from gene flow, it also affects colonization and plant ecology, changes in gene frequencies within populations, geographic plant distributions on a broader scale, etc. (Levin *et al.* 2003, Cousens *et al.* 2008). Most of the dispersal takes place on a local scale, but a LDD is the major evolutionary factor that allows plants to colonize unoccupied habitats and thus enhance the fitness of populations (Webb 1998, Cousens *et al.* 2008). Dispersal has three elementary factors, (i) parental source of propagules, (ii) distance between source and target locations, and, last but not least, (iii) vector of the movement (i.e., water dispersal – hydrochory, wind dispersal – anemochory and animal dispersal – zoochory; Cain *et al.* 2000, Cousens *et al.* 2008, Jordano 2017). Germination capacity and the ability to occupy a new environment can also significantly influence the success of the transfer (Jordano 2017).

Seeds in the genus *Urtica* have the form of tiny and hard achenes (monocarpellary, indehiscent) which are dispersed in forms without a perianth, or with an enclosed and dry perianth, generally with no obvious adaptation for long-distance dispersal (Friis 1993, Wu *et al.* 2018). Observed exceptions are Mediterranean species *U. stachyoides* Webb & Berthel. and *U. morifolia* Poir., producing sweet mucilage on achenes probably to easily adhere to the feathers of birds (or other coats of animals), or to encourage the consumption of seeds by birds. Another is the South American species *U. trichantha* (Wedd.) Acevedo & L.E.Navas, which has the perianth of the achenes densely covered with large trichomes that probably serve to stick to animals (Navas 1961, Grosse-Veldmann 2016). The achenes of individual *Urtica* species can be well distinguished from each other even in sediments, which can be used in paleoecology to study the distribution of individual taxa from a historical perspective (Knobloch & Mai 1986, Chrtek 1979, Wolters *et al.* 2005, Deng *et al.* 2013). In terms of the vector of the movement, representatives of the genus use various seeds dispersal mechanisms, which allow them to successfully colonize the mainland and also facilitates dispersal between continents and different islands, as evidenced by the number of island endemics through the whole *Urtica* genus (Grosse-Veldmann *et al.* 2016, Grosse-Veldmann 2016). The potential for long-distance seed transfer in ocean water has been investigated experimentally (Wu *et al.* 2018), where it has been shown that seeds of *Urtica* species are able to survive on average up to 240 days in a saline solution with a concentration of 35 PSU (which is the average salinity of seawater). Due to the semi-land enclosed basin with prevailing evaporation over precipitation and tributaries, the salinity within the Mediterranean Sea increases eastwards (Fig. 4). However, higher salinity values should have no major effect on the survival of the seeds in seawater, as also shown by experiments, where the salinity concentration of the solution was increased up to 8% and the seeds were still viable (Wu *et al.* 2018). Other specific phenomena which can affect seed dispersal within the landlocked Mediterranean Sea include the strengths and spatial limitations of currents and tides (Fig. 4), significant seasonal variability, and heavily plastic-polluted offshore areas (Millot 1999, Sorgente *et al.* 2003, Cózar *et al.* 2015, Soukissian *et al.* 2017, Pasternak *et al.* 2018, Beccario 2022). On the mainland, animal and water dispersal predominated as the primary means of dispersal. Despite the developed mechanism of stinging trichomes with toxic substances (probably as a defense against mammalian herbivores), the presence of seeds of the genus *Urtica* in excrements were confirmed to be relatively common. Seeds have most frequently been found in feces of birds and droppings of herbivorous animals, often having passed through the digestive tract intact, which can help wide dispersal and also better germination. For example, in the case of the most studied species *U. dioica*, its seeds represented up to 70–80% of germinated seedlings in endozoochorous samples (Couvreur *et al.* 2005, Holland *et al.* 2006, Eycott *et al.* 2007, Kuiters & Huiskes 2010). Another characteristic of the seeds is the ability to stay dormant for a relatively long time. In the most widespread species (e.g., *Urtica dioica*, *U. urens*), the ability to form persistent seed banks (on the order of years) has been observed, which may be advantageous in the long-term strategy and contribute to better adaptation in changing environmental conditions (Thompson & Grime 1979, Roberts & Boddrell 1984, Šrůtek & Teckelmann 1998, Lati *et al.* 2016). Secondary strategy for colonization of the mainland that is essential for spreading over short distances and for the stabilization of newly originated types (like new polyploid lineages) is the vegetative reproduction by underground stolons (e.g., the most studied species is *U. dioica*; Hara & Šrůtek 1995, Oñate & Munné-Bosch 2009). Plants also have the ability to regenerate from small, separate parts of stolons. That enables other potentially successful ways of transfer, such as floating vegetation island or hydrochorous transfer of whole floating plant (Wu *et al.* 2018).

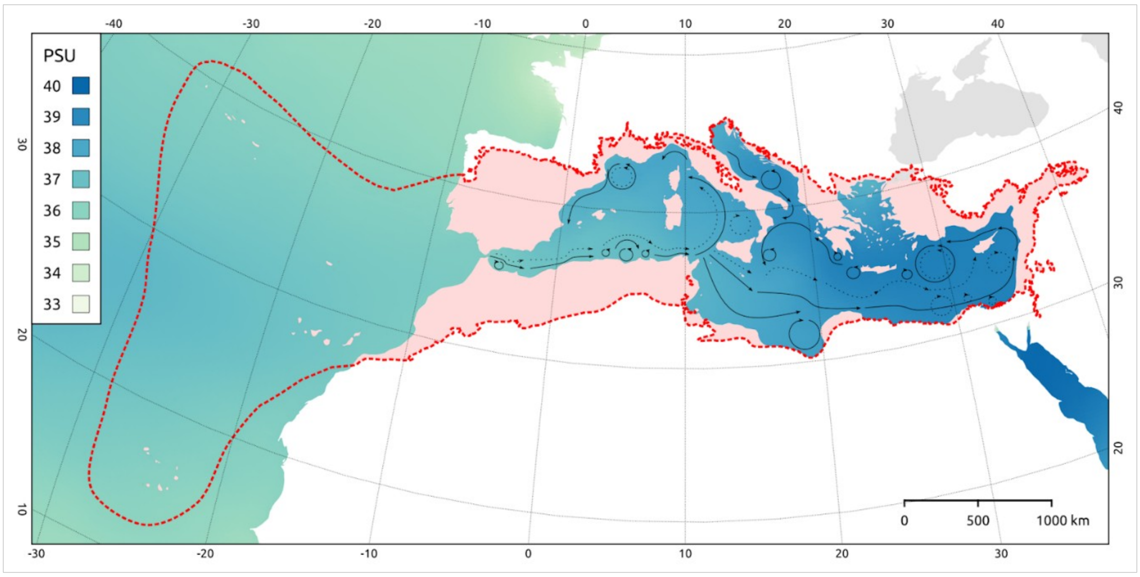

Figure 4. The major currents in the Mediterranean Sea along with the average surface salinity in the Mediterranean Sea. Delimitation of Mediterranean Basin (fully-colored red area) along with Macaronesia region, belonging to the Mediterranean hotspot (red dashed line). Summer circulation (black dashed arrows line) and winter circulation (solid black arrows line). Mapped average surface salinity data for the period 2020. **Data source**: Pinardi & Masetti 2000, Buongiorno Nardelli *et al.* 2016, Droghei *et al.* 2016, Droghei *et al.* 2018, Copernicus Marine Service, Natural Earth – Free vector and raster map data, Center for Applied Biodiversity Science at Conservation International 2011).

Sex and gender distribution

In addition to LDD, further life-history traits which affect the success of colonization and adaptation is the reproductive system and gender distribution. The genus *Urtica* is specific for having almost exclusively unisexual flowers (Friis 1993), which is quite rare within flowering plants, with only about 10% of all representatives being unisexual (Barrett 2002). This floral structure promotes obligate outcrossing and prevents selfing. Apart from sporadic pollination by insect visitors (by *U. dioica* and possibly other species; Taylor 2009), the species are wind-pollinated with explosive anthers that literally throw pollen grains into the environment. This can lead to self-pollination in monoecious representatives, despite the unisexual architecture. The explosive mechanism may be associated with the spread of pollen grains over long distances, thus it could facilitate gene flow between remote populations (Alcázar *et al.* 1998, Ranta *et al.* 2008). This is advantageous especially for anemophilous Urticaceae species growing in tropical conditions, where the transport is inhibited by high moisture and pollen grains being washed out of the air by rain (Montoya-Pfeiffer *et al.* 2016). Another phenomenon related to the sexual system and reproduction, which significantly shapes not only the whole genus but the entire family, is dioecy. Of all the genera in Urticaceae, 52% are dioecious (within flowering plants, the proportion of dioecious genera is estimated at only 7% = ca 987 genera, earlier estimation 4%; Dellaporta & bCalderon-Urrea 1993, Renner & Ricklefs 1995, Renner 2014), while many of them also contain both mono- and dioecious forms. Each species that has both dioecious and a monoecious form provides an opportunity to explore the origin and development of these sexual systems. Especially in the genus *Urtica*, we can encounter transition states at the level of diversification of gender patterns with a transient architecture (see Grosse-Veldmann & Weigend 2018). The evolution of both dioecy and transition states has not yet been satisfactorily explained (Spigler & Ashman 2012, Charlesworth, 2013, Dufay *et al.* 2014, Grosse-Veldmann & Weigend 2018). However, random sex switching may play an important role in the adaptation of individuals in case of LDD events. More than 48% of LDD events within Urticaceae were observed in dioecious

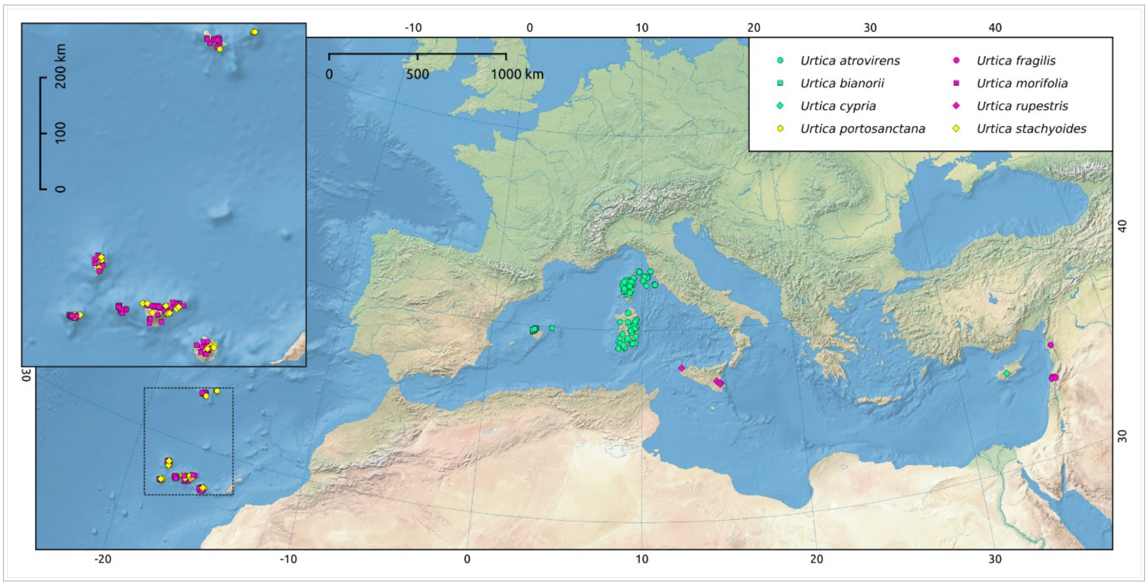

Figure 5. Spatial distribution of endemic species of the genus *Urtica* in Mediterranean hotspot. Spatial representation of phylogenetic relations between the Mediterranean endemic species of the genus *Urtica*. Distinguished are the bright green group (*Urtica atrovirens*, *U. bianorii*, *U. cypria*), magenta group (*Urtica fragilis*, *U. morifolia*, *U. rupestris*), yellow group (*Urtica portosanctana*, *U. stachyoides*). Map section in the top left corner – detail of the Canary Islands and Madeira. Detail of the phylogenetic reconstruction of *Urtica* species in Fig. 7. **Data source:** National Center for Biotechnology Information database, Natural Earth – Free vector and raster map data, GBIF 2022, Grosse-Veldmann *et al.* 2016, Rejlová *et al.* 2021.

Phylogenetic background

Phylogeny of island endemics species in Mediterranean hotspot

Recent phylogenies by Huang *et al.* 2019 and Wu *et al.* 2018 have focused not only on phylogenetic relationships within the Urticaceae family, but also to improve the accuracy of molecular dating, which has been only marginally investigated so far. These complex studies have helped to give a better conception about the number of LDD events as well as possible directions of migration/dispersal with an insight into subsequent evolutionary development at various nodes of the phylogenetic tree. The acceleration of diversification in the Urticaceae is estimated to 45 Mya, when ≥ 92

LDD events were detected and ca 76 of them were likely associated with transmission across at least one ocean (Wu *et al.* 2018). The high number of LDD events may be related to the relatively high number of island endemics occurring within the genus *Urtica* (Grosse-Veldmann *et al.* 2016, Stevens 2017), with at least two or more colonization events recorded for most islands (excluding Hawaii and Juan Fernández Islands; Grosse-Veldmann *et al.* 2016). A detailed phylogenetic study of the genus *Urtica* by Grosse-Veldmann *et al.* 2016 (including 61 from a total of 63 species) covers a total of 16 island endemics, of which almost half can be found in the Mediterranean hotspot (*U. atrovirens*, *U. bianorii*, *U. cypria*, *U. morifolia*, *U. portosanctana*, *U. rupestris*, *U. stachyoides*; data with distribution records in Fig. 3). This comprehensive phylogeny provided the most valuable insight into the phylogenetic relationships in this important center of biodiversity (spatial representation of phylogenetic relations are shown in Fig. 5). The most spatially diverse is the Macaronesian-Mediterranean group including *U. fragilis* (inland endemic of Lebanon) + *U. morifolia* (Canary Is.) + *U. rupestris* (Sicily), which belongs to the Morifolia clade. In relation to the spatial distribution and place of their typical occurrence (Table 1), transfer by animals (specifically by birds) seems most likely, but other possibilities or their combinations mentioned above cannot be ruled out either. In case of *U. rupestris*, which is generally reported in the literature as a dioecious species (the transient state was also recorded see Grosse-Veldmann & Weigend 2018; Fig. 6, Table 1), multiple seed transfer was likely required for successful colonization (Tutin 1993, Pignatti 1982, Grosse-Veldmann & Weigend 2018, Wu et al. 2018, Pignatti 2019). Another, already intra-Mediterranean group consists of *U. atrovirens* (Corsica) + *U. bianorii* (Balearic Is.) + *U. cypria* (Cyprus) forming a Mediterranean subgroup within the extensive clade of *U. dioica* sl. and is closely related to the Central African species *U. simensis* and *U. massaica*. This intercontinental relation can be attributed to the period of the Messian event, associated with migration between these continents, which is consistent with the dating in recent phylogenies (Krijgsman *et al*. 1999, Roveri *et al*. 2014, Médail 2017, Wu *et al*. 2018, Huang *et al* 2019). The last group belonging to the Mediterranean hotspot (the geographical unit of Macaronesia; Fig. 1) is *U. portosanctana* (Madeira) + *U. stachyoides* (Canary Is.) rank in the Urens clade. For the last two mentioned groups, possible LDD transmission by ocean water cannot be excluded, however none of the representatives grow in habitats close to the sea except for *U. portosanctana*, which can be found in spots near the shore (Table 1; Wu *et al.* 2018). A similar phylogenetic pattern (as in Grosse-Veldmann *et al.* 2016) can be found in the latest phylogeny of Huang *et al*. 2019 focusing on the whole Urticaceae family, albeit some endemic species were not included (*Urtica fragilis*, *U. cypria*, *U. bianorii*).

Table 1. Mediterranean endemics *Urtica* species with their sex, transient states and typical occurrence.

Taxon	Sex	Transient states*	Typical occurrence
Urtica atrovirens Req. ex Loisel.	monoecious[§]	proxiandrous monoecy[+]	ruderal sites along roads and walls[(1)]
Urtica bianorii (Knoche) Paiva	monoecious[β]	proxiandrous monoecy	nitrogen-rich and shadowed places on rocky outcrops with frequent grazing[(2)]
Urtica cypria (H. Lindb.) Hand	monoecious[%]	basiandrous monoecy[ω]	the synanthropic locations of waste ground, moist walls, and field terraces[(3)]
Urtica fragilis J.Thiébaut	monoecious[#]	basigynous gynodioecy[€]	rocky foothills or cracks of limestone rocks[(4)]
Urtica morifolia Poir.	monoecious[@]	basigynous gynodioecy	shady and moist areas of laurel forests[(5)]
Urtica portosanctana Press	monoecious[?]	basigynous monoecy[π]	dry rocky places on cliffs and dry slopes near the sea[(6)]
Urtica rupestris Guss.	dioecious [$]	basigynous gynodioecy	shady rocky outcrops within mesophilic holm oak woods[(7)]
Urtica stachyoides Webb & Berthel.	monoecious[!]	basigynous monoecy	rock ledges, around paths near walls in hedges[(8)]

[+]the basal inflorescence branches are female, median and apical inflorescences have male flowers proximally and female flowers distally on each inflorescence branch; [ω]basal inflorescence branches are male and the distal ones female, usually with one or two mixed nodes intercalating between them; [€]populations consist of female individuals and monoecious individuals shown basiandrous monoecy; [π]the basal inflorescences are female and median and apical inflorescence branches with both male and female flowers mixed randomly on each inflorescence.

Data source: [§]Pignati 2019, Tutin 1993; [β]Paiva 1993; [%]Weigend 2016, Christofides 2017; [#]Weigend 2016, Tohmé & Tohmé 2017; [@] Schönfelder & Schönfelder 2002, Webb & Berthelot 1835; [?]Press 1988; [$] Tutin 1993, Pignatti 1982, 2019; [!]Webb & Berthelot 1835; [*]Grosse-Veldmann & Weigend 2018; [(1)]Pignati 1982, 2019; [(2)]Paiva 1993; [(3)]Meikle 1985, Weigend 2006; [(4)]Thiébaut 1935; [(5)]Webb & Berthelot 1835, Schönfelder & Schönfelder 2002; [(6)]Press 1988; [(7)]Fenu et al. 2019, Pignati 2019;[(8)]Webb & Berthelot 1835.

By combining phylogenetic reconstruction and estimation of absolute genome size, a broader insight into relationships within the Mediterranean endemic taxa can be obtained (Grosse-Veldmann *et al.* 2016, Rejlová *et al*. 2019, 2021). Absolute genome size is a suitable taxonomic marker and may be indicative of genetic distance (Loureiro *et al.* 2010, Yan *et al.* 2016). Such is the case with *U. bianorii*, which was initially classified as a variety or subspecies of *U. atrovirens* based on similar morphology (Paiva 1992, 1993), whereas both species can be reliably distinguished by differences in the size of their genomes (Rejlová *et al.* 2019). Further example is *U. cypria*, whose estimated genome size values[1] (Rejlová *et al*. 2019) along with phylogenetic reconstruction (Fig. 7; Rejlová *et al*. 2021) indicate close relationships with other Mediterranean island endemic species (previously proposed by Hand 2019) outside of the *U. dioica* complex, to which it was previously assigned as one of the subspecies (Table 2; Meikle 1985, Grosse-Veldmann *et al.* 2016, Christofides 2017, Weigend 2006).

[1] Previous study Rejlová et al. 2019 estimated 1-Cx value for *U. cypria* incorrectly. Authors expected a triploid level that was in congruence with the genome sizes of studied subspecies of *U. dioica*. The value reported in Table 2 was supported by an exact chromosome count (Lučanová *et al.* unpublished data).


HERBARIUM UNIVERSITATIS CAROLINAE PRAGENSIS – PRC
Urtica rupestris Guss.
Sicily
Riserva naturale integrate Grotta Monello.
37°00'52,1"N 15°10'14,9"E
Notes: rocky mountains with a cave system in Riserva naturale integrate Grotta Monello, individual with transient sex state (monoecious) | U4213; ploidy level assessed by flow cytometry: genome size (2C-value) = 0.70 / 684.6 pg / Mb
2021-09
Coll./Det.: Eliška Havlíčková
0 1 2 3 4 5 6 7 8 9 10
cm
copyright reserved
HERBARIUM UNIVERSITATIS
PRC
CAROLINAE PRAGENSIS
A

← **Figure 6. A) Herbarium specimen of *Urtica rupestris*.** Scanned herbarium specimen of *Urtica rupestris* from our collection (U4213) from Riserva naturale integrate Grotta Monello (Italy, Sicily), detail of the photographed area with transient sexual state marked with black dotted line **B) Detail of transient sex state of *Urtica rupestris*.** Detailed display of transient sex state (monoecious). Detail of female inflorescences with ripening achenes (growing in the middle or lower levels of the plants) in the upper right corner, detail of male inflorescence with anthers (growing mostly at the top of plants) in the lower right corner.

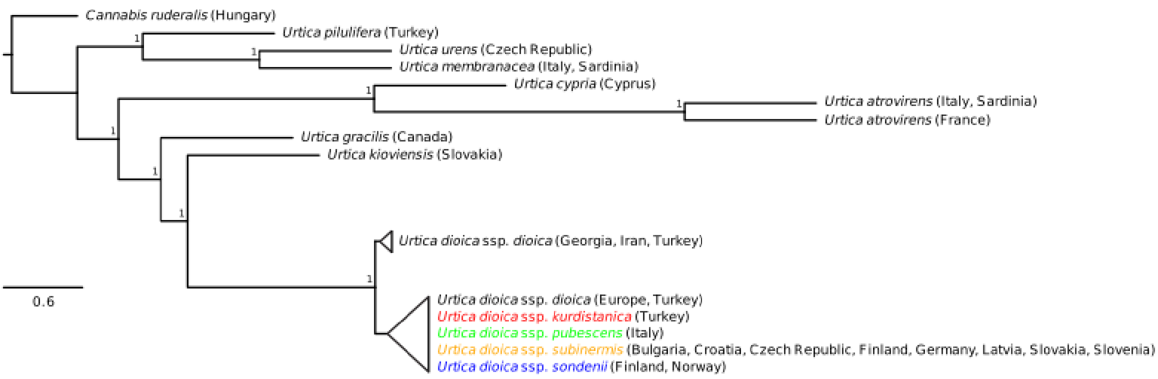

Figure 7. Phylogenetic reconstruction of evolutionary relationships among *Urtica* species (the pictures adopted from Rejlová *et al*. 2021). Phylogenetic reconstruction of evolutionary relationships among *Urtica* species based on coalescence analysis (ASTRAL) using 249 gene trees. Local posterior probabilities for the ASTRAL analysis are shown at the nodes. Branch length, representing substitutions per site, is indicated by the scale bar. The full version of the tree and more details is shown in Rejlová *et al.* 2021.

Table 2. Established genome sizes supplemented by chromosome numbers for selected *Urtica* species.

Taxon	Genome size (1C-value; pg / Mb)	Chromosome counts
Urtica atrovirens Req. Ex Loisel.	0.60 / 586.8	26[*]
Urtica bianorii (Knoche) Paiva	0.83 / 806.85	26[#]
Urtica cypria (H. Lindb.) Hand	0.83 / 811.25	26[$]
Urtica rupestris Guss	0.35 / 341.81	26[*]
Urtica subsp. *dioica* L.	1.09 / 1066.02	52[€]
U. d. subsp. *pubescens* Ledeb.	0.58 / 567.24	26[€]
U. d. subsp. *sondenii* (Simmons) Hylander	0.57 / 557.46	26[€]
U. d. subsp. *subinermis* R. Uechtr.	0.58 / 562.35	26[€]

Genome sizes adopted from Rejlová *et al.* 2019, source of chromosome numbers: [*]Corsi *et al.* 1999; [#]Corsi 2000; [$]Lučanová *et al.* unpublished data; [€]Rejlová *et al.* 2019.

Conclusion

The combination of specific biogeographical conditions has shaped Mediterranean into an area that has allowed the preservation of relict flora but has also become the cradle of the evolution and diversification of many plant species. Most of the large islands and archipelagos of the Mediterranean have been well floristically studied, but smaller and remote islands, which may form an important migratory path, have not yet been mapped. Detailed vegetation examination, together with an interdisciplinary approach (such as radiometric dating, oceanography, human migration etc.), provides an opportunity to elucidate the links and phenomena behind plant diversification. However, it can also provide an insight into the trends that can be used for adaptation and management of this unique region, for example with regard to climate change or the spread of nonnative plant species threatening rare island communities.

Presented review deals with the genus *Urtica*, which is the largest genus within the family Urticaceae with the European center of diversity in the Mediterranean hotspot. Phylogenetic data identify the most basal ancestor as a species whose origin is linked to the Mediterranean region. In addition, the current phylogenies have also been combined with molecular dating (that remain only marginally studied), which has allowed to contextualize LDD events together with history of Mediterranean islands with *Urtica* endemics and ancient events in hotspot. Long-distance dispersal events are further discussed in relation to other life history traits that may have led to their diversification, establishment and the origin of the high degree of island endemism within the whole genus *Urtica*. A deeper understanding of the processes particularly on the topic of the possibility and extent of selfing, transitional forms of sex architecture – their origin and function, and ecological and habitat preferences, can help clarify the apparent contrast in *Urtica* genus between island endemism and mainland cosmopolitan expansion, with an invasive character of some representatives.

Released research also clarifies some disputed nodes in phylogeny of the genus *Urtica* and provides new evidence to support them. It has been shown that genome size can be used as an additional character in determination and may be indicative of genetic distance. Indeed, most of the Mediterranean *Urtica* island endemics have significantly mutually differing values. In addition, another advantage of differing genome sizes is also the ability to determine juvenile stages of plants, which can be useful e.g., in conservation programs such as Care Mediflora (Care Mediflora, 2022) programme for *U. rupestris*.

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APPENDICES

<u>APPENDIX I:</u> *Urtica kioviensis* Rogow. × *Urtica dioica* L.

Urtica kioviensis Rogow. × *Urtica dioica* L. (J Hadinec and P Lustyk, Eds). Additamenta ad floram Reipublicae Bohemicae XVI. Zprávy České botanické společnosti

53: 31–112.

Urtica kioviensis Rogow. × *Urtica dioica* L.

Lokace:

18a. Dyjsko-svratecký úval (7065d), obec Ivaň (okres Brno-venkov): PR Plačkův les a říčka Šatava, tůň u lesní cesty cca 400 m JJV od samoty Plaček, 2 km SV od kostela v obci Ivaň, 48°56'40"N, 16°35'25,6"E, 151 m n. m., porost na ploše cca 50 m^2 (2. 5. 2017; leg. L. Rejlová, Š. Svobodová).

Urtica kioviensis Rogow. (kopřiva lužní) byla dosud na území ČR zaznamenána pouze na několika lokalitách (recentně NPR Cahnov, NPR Ranšpurk a PR Plačkův les a říčka Šatava; Danihelka & Lepší 2004, Hájek 2013). Ve zmíněných populacích však roste sympatricky s *U. dioica* L. (kopřiva dvoudomá), což vytváří vhodné podmínky pro hybridizaci obou druhů. Možnost hybridizace *U. kioviensis* a *U. dioica* byla dosud naznačena jen v několika případech v zahraničních publikacích (Buchwald 2013, Karlsson & Agestam 2013), což je bezesporu způsobeno přehlížením samotné *U. kioviensis*. Z území ČR nebyl případ křížení zatím popsán. Hybridní jedinci byli zaznamenáni na lokalitě PR Plačkův les a říčka Šatava, z které byl výskyt *U. kioviensis* již znám (Kolář et al. 2014). Rostliny se projevují intermediárním habitem: oproti *U. dioica* výrazněji dutá lodyha, tendence kořenit z nodů, palisty volné (po celé délce lodyhy), čepel na svrchní straně s ojedinělými základními trichomy.

Hybridní původ byl kromě intermediární morfologie také následně ověřen prostřednictvím průtokové cytometrie, jelikož se obsah relativní jaderné DNA diploidní *U. kioviensis* (2C = 1,14 pg DNA) od tetraploidního cytotypu *U. dioica* (2C = 1,94 pg) markantně liší. U hybridních jedinců odpovídala hodnota obsahu DNA (pg) polovičnímu přispění obou rodičovských druhů (tj. 2C = 1,53 pg DNA), což indikuje DNA triploidní úroveň (ploidie odhadnuta na základě průtokové cytometrie). Srovnávací vzorky obou rodičovských druhů byly rovněž odebrány na lokalitě PR Plačkův les a říčka Šatava. Je možné, že se hybridi vyskytují i na dalších místech sympatrického výskytu obou druhů, a proto je třeba do budoucna věnovat pozornost nejen rozeznávání *U. kioviensis*, ale i hybrida s *U. dioica*.

Rejlová L. & Urfus T.

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APPENDIX II: *Urtica kioviensis* Rogow. in Nature Reserve "Plačkův les a říčka Šatava"

Urtica kioviensis Rogow. (J Hadinec and P Lustyk, Eds). Additamenta ad floram Reipublicae Bohemicae XII. Zprávy České botanické společnosti 49: 200–201.

Urtica kioviensis Rogow.

Lokace:

18a. Dyjsko-svratecký úval, 7065d, Ivaň (distr. Brno): PR Plačkův les a říčka Šatava, tůň u lesní cesty ca 400 m JJV od samoty Plaček, 2 km SV od kostela v obci 48°56'40"N, 16°35'25,6"E, 151 m n. m., porost na ploše ca 50 m^2 (9. 5. 2013 leg. F. Kolář, T. Urfus, L. Rejlová & F. Holič, PRC).

Rostliny kopřivy lužní byly v květnu nalezeny ve vegetativním stavu, kromě běžné determinace pomocí morfologických znaků jsme proto přistoupili i k ověření správnosti určení pomocí průtokové cytometrie (srovnáním s rostlinou z lokality Ranšpurk u Lanžhota a s cytotypy *U. dioica*). Obsah jaderné DNA kopřivy lužní je 1,34 pg DNA a je tedy o ca 19 % větší než obsah DNA diploidního a o ca 65 % menší než tetraploidního cytotypu kopřivy dvoudomé (*U. dioica*). Průtoková cytometrie se tedy jeví jako vhodný nástroj k ověřování determinace sporných rostlin v rodu *Urtica*, popř. drobných fragmentů ve vegetativním stavu. Druh byl historicky znám od Moravského Písku a v poslední době byl zjištěn na dvou místech v oblasti Soutoku Moravy a Dyje (Danihelka & Lepší 2004), Hájek in Additamenta 11: 131, 2013). Nově objevená lokalita je prvním recentním údajem mimo oblast Soutoku a vůbec prvním v povodí Svratky. Vzhledem k zachovalému stavu lokality je pravděpodobné, že se zde kopřiva lužní bude vyskytovat na více místech.

F. Kolář, T. Urfus & L. Rejlová

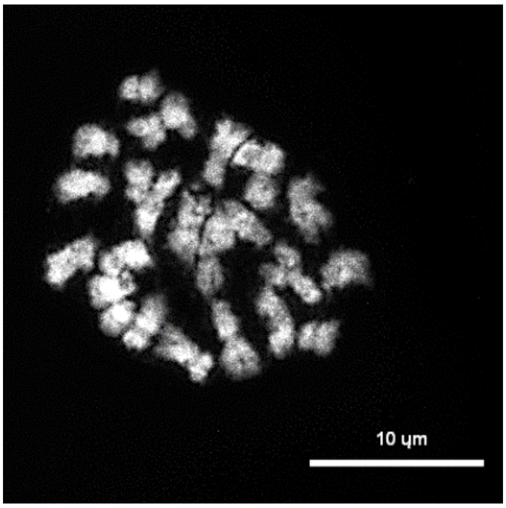
Danihelka J. & Lepší M. (2004): Kopřiva lužní, *Urtica kioviensis*, na soutoku Moravy a Dyje. – Zprávy Čes. Bot. Společ. 39: 25–35.

APPENDIX III: Chromosome count of *Urtica cypria* (H. Lindb.) Hand (unpublished data)

***Urtica cypria* (H. Lindb.) Hand (Urticaceae)** 2n = 26 Lučanová

Locality: Cyprus, in the vicinity of Polistipos and Alona villages, 2017, 1077 m a.s.l., Hazel (*Corylus*) tree grove near the roadside number E931, coll./det.: Trávníček P. & Chumová Z.

Genome size assessed by flow cytometry (1C-value; pg/ Mb) = 0.83 / 811.25. Herbarium specimen deposit in PRC – Herbarium Universitatis Carolinae Pragensis. To our knowledge, it is the first time that chromosome count of *U. cypria* was conducted. Literary sources for the determination of individuals: Meikle, 1985; Weigend, 2006; Christofides, 2017; Hand, 2019).



Microphotographs of somatic metaphases of *Urtica cypria* (H. Lindb.) Hand (2n = 2x = 26). Performed by Magdalena Lučanová (unpublished data; individual UP1219/U1730, Polistipos/Alona, Cyprus).

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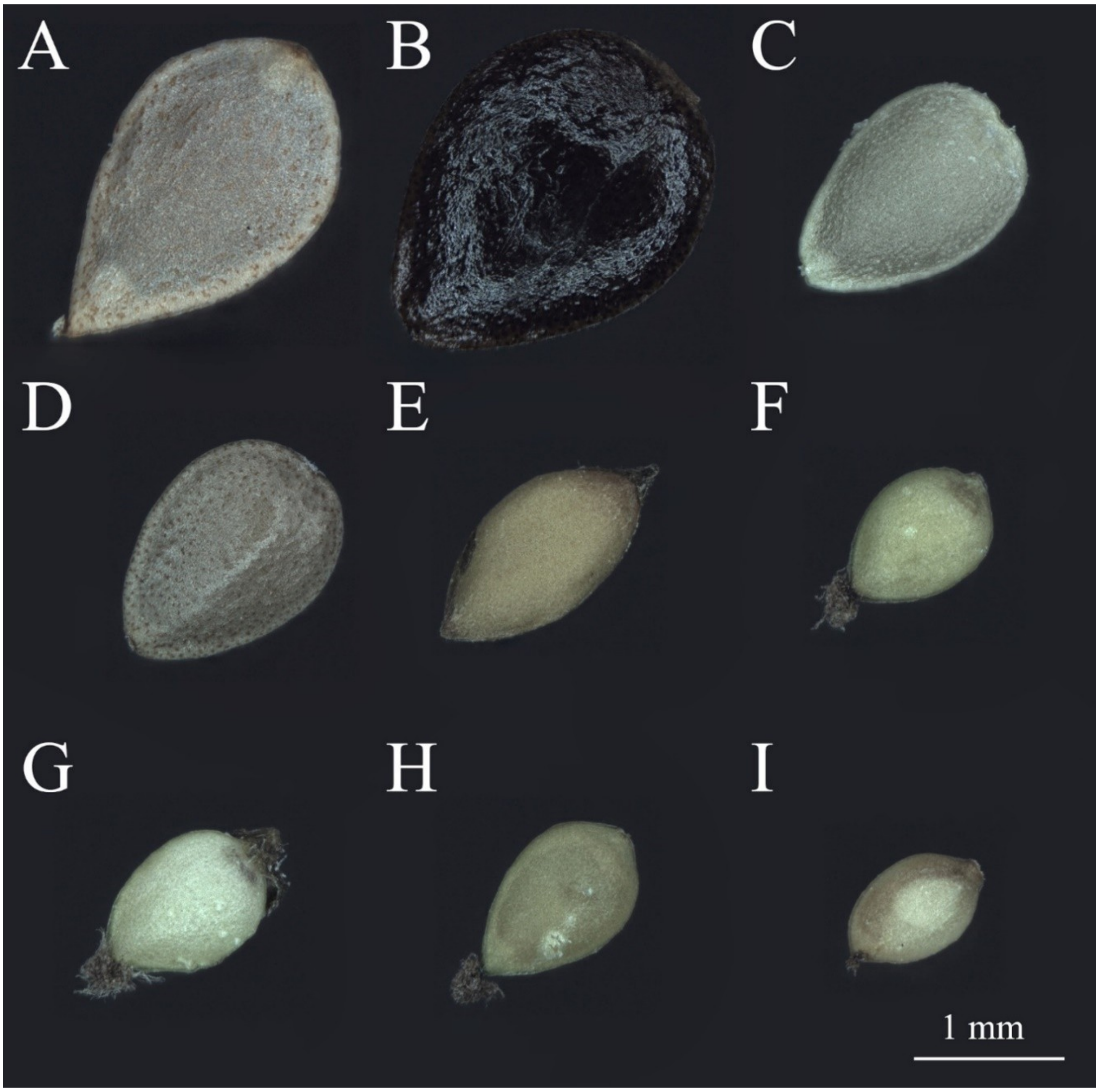
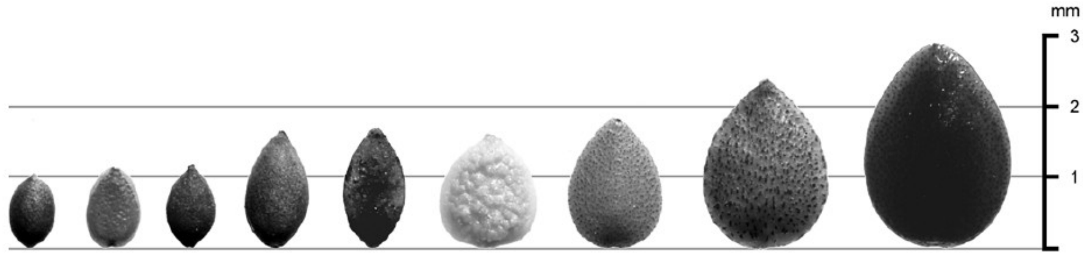
APPENDIX IV: Examples of the morphology of the achenes of species within the *Urtica* genus



(A) *Urtica cannabina* (Southwest Asia, removed from herbarium item in Herbarium of the Charles University, Prague – PRC); **(B)** *Urtica pilulifera* (Turkey, population UP1251, Supporting Table 1 in **CS II**); **(C)** *Urtica urens* (the Czech Republic, population UP1255, Supporting Table 1 in **CS II**); **(D)** *Urtica membranacea* (Greece – Samos, individual U0248); **(E)** *Urtica kioviensis* (the Czech republic – "Plačkův les", individual from cultivation); **(F)** *Urtica dioica* subsp. *dioica* (tetraploid ploidy level, the Czech Republic, population UP0079/individuals U0199, Supporting Table 1 in **CS I**); **(G)** *Urtica dioica* subsp. *subinermis* (diploid ploidy level, the Czech Republic, population UP0081/individuals U0201, Supporting Table 1 in **CS I**); **(H)** *Urtica dioica* subsp. *dioica* (tetraploid ploidy level, the Po river basin, northern Italy, population UP0003/individuals U0007, Supporting Table 1 in **CS I**); **(I)** *Urtica dioica* subsp. *pubescens* (diploid ploidy level, the Po river basin, northern Italy, population UP0013/individuals U0049, Supporting Table 1 in **CS I**; photo by Ludmila Rejlová).



Comparison of recent nutlets (achenes) of selected European *Urtica* species. From left to right: *Urtica atrovirens*, *U. membranacea*, *U. dioica*, *U. kioviensis*, *U. kioviensis* (subfossil), *U. morifolia*, *U. urens*, *U. cannabina*, *U. pilulifera* (the picture adopted from Wolters *et al.*, 2005).

APPENDIX V: Author contribution to included case studies

CONTRIBUTION OF LUDMILA REJLOVÁ TO THE FOLLOWING ARTICLES:

I hereby declare that I have substantially contributed to all the articles included in the thesis. My contributions to the articles are as follows:

I. **Rejlová L.**, Chrtek J., Trávníček T., Lučanová M., Vít P., Urfus T. (2019) Polyploid evolution: The ultimate way to grasp the nettle. Plos One 14: e0218389.

   study design, field sampling, data analyses, plant cultivation, lab work, manuscript writing and preparation – total contribution 70%

II. **Rejlová L.**, Böhmová A., Chumová Z., Hořčicová Š., Josefiová J., Schmidt P.-A., Trávníček P., Urfus T., Vít P., Chrtek J. (2021) Disparity between morphology and genetics in *Urtica dioica* (Urticaceae). Botanical Journal of the Linnean Society 195: 606–621.

   study design, field sampling, data measurement, data analyses, manuscript writing and preparation – total contribution 65%

III. **Rejlová L.** Close, yet so distant: Diversification and island colonization in the genus *Urtica* L. (Urticaceae Juss.) in the Mediterranean biodiversity hotspot (unpublished review).

   conceptualization, manuscript writing, and preparation – total contribution 100%

Supervisor
Mgr. Jindřich Chrtek, CSc.

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AGENTURA OCHRANY PŘÍRODY A KRAJINY ČESKÉ REPUBLIKY

REGIONÁLNÍ PRACOVIŠTĚ JIŽNÍ MORAVA

ODDĚLENÍ
Správa CHKO Pálava
Náměstí 32
692 01 Mikulov
tel.: 519 510 585
ID DS: ngbdyqr
e-mail: palava@nature.cz
www.nature.cz

Adresáti
dle rozdělovníku

NAŠE ČÍSLO JEDNACÍ: SR/0076/JM/2019-3 **VYŘIZUJE:** Dedek **DATUM:** 28. 3. 2019

Rozhodnutí podle zákona ČNR č. 114/1992 Sb., o ochraně přírody a krajiny v platném znění, ve věci povolení výjimky

Agentura ochrany přírody a krajiny ČR (dále jen „Agentura“ či „správní orgán“), jako příslušný orgán ochrany přírody podle ustanovení § 78 odst. 1 zákona ČNR č. 114/1992 Sb., o ochraně přírody a krajiny, v platném znění (dále jen „zákon“), na základě žádosti spol. Botanický ústav AV ČR, v.v.i., Zámek 1, 252 43, Průhonice, IČO 67985939, ze dne 26. 2. 2019 a provedeného správního řízení podle zákona č. 500/2004 Sb., správní řád, v platném znění (dále jen „správní řád“), vydává toto

ROZHODNUTÍ.

Podle ustanovení § 43 odst. 1 zákona se společnosti Botanický ústav AV ČR, v.v.i., Zámek 1, 252 43, Průhonice, IČO 67985939 (dále jen „žadatel“),

povoluje výjimka

ze základních ochranných podmínek národní přírodní rezervace (dále jen „NPR“) Ranšpurk a to konkrétně ze zákazů stanovených v § 29, písm. d) vstupovat mimo cesty vyznačené se souhlasem orgánu ochrany přírody pro území a § 29 písm. i) sbírat rostliny, a to pro území NPR Ranšpurk.

Výjimka se povoluje pro účely realizace projektů GAČR č. p. 17-20201S - Invaze vs. expanze - záhadný původ široce rozšířeného druhu *Urtica dioica* (*Urticaceae*) a GAUK č. p. 1206617 - Neznámý původ globálně úspěšné kopřivy dvoudomé (*Urtica dioica*).

Výjimka se povoluje za těchto podmínek:
1. Jednotlivé vstupy na území NPR budou vždy min. 1 den předem oznamovány Agentuře, konkrétně Správě CHKO Pálava, a to buď telefonicky (602 225 748) nebo emailem (pavel.dedek@nature.cz).
2. Při poslední návštěvě území bude veškerý materiál, použitý pro vyznačování experimentální ploch a jakýkoliv jiný žadatelem použitý materiál z NPR odstraněn.
3. Žadatel je povinen do 6ti měsíců po ukončení výzkumu předložit AOPK ČR, RP Jižní Morava, oddělení Správa CHKO Pálava souhrnnou zprávu z předmětného výzkumu. Za ukončení výzkumu je považováno publikování výsledků v odborném periodiku, formou diplomové či disertační práce apod.
4. Výjimka se povoluje na dobu určitou, a to od nabytí právní moci tohoto rozhodnutí do konce roku 2019.

Odůvodnění:

Dne 26. 2. 2019 obdržela Agentura žádost organizace Botanický ústav AV ČR, v.v.i., Zámek 1, 252 43, Průhonice, IČO 67985939 o povolení výjimky dle § 43 odst. 1 pro území Národní přírodní rezervace (dále jen "NPR") Ranšpurk, a to z následujících zákazů, uvedených v § 29 zákona: vstupovat a vjíždět mimo cesty vyznačené se souhlasem orgánu ochrany přírody (§ 29, písm. d) a sbírat rostliny (§ 29, písm. i). Výjimka byla požadována pro účely realizace projektů GAČR č. p. 17-20201S - Invaze vs. expanze - záhadný původ široce rozšířeného druhu *Urtica dioica* (*Urticaceae*) a GAUK č. p. 1206617 - Neznámý původ globálně úspěšné kopřivy dvoudomé (*Urtica dioica*) a v rámci nich jsou plánovány celkem tři vstupy na území NPR Ranšpurk: první v květnu pro založení experimentální plochy (dvě až tři plochy o rozměrech 20x20 m), označení a odběr rostlinného materiálu (2-4 listy/jedince kopřivy dvoudomé), druhá v červenci pro kontrolu experimentální plochy a třetí, poslední, pro odebrání zralých semen z jedinců kopřivy dvoudomé pro následné analýzy.
NPR Ranšpurk byla žadatelem zvolena ze dvou důvodů - jde o oplocené území a je tak eliminováno nebo alespoň výrazně omezeno riziko zničení experimentálních ploch zvěří a dále je populace kopřivy dvoudomé v tomto území v těsném kontaktu s populací kopřivy lužní (*Urtica kioviensis*) a jedním z cílů projektu je i prověřit možné křížení těchto dvou blízce příbuzných druhů.

Správní orgán oznámil zahájení správního řízení dalším účastníkům, kterými jsou v tomto případě Město Lanžhot, na jehož katastrálním území má být záměr realizován a Lesy ČR s.p., Lesní závod Židlochovice jako subjekt, jemuž bylo svěřeno právo hospodaření na dotčených pozemcích.
Dále byly o zahájeném správním řízení informovány spolky Česká společnost ornitologická – Jihomoravská pobočka, Lidická 25/27, 602 00 Brno, Česká společnost ornitologická, Na Bělidle 34, 150 00 Praha-Smíchov a Česká společnost pro ochranu netopýrů, Viničná 1594/7, Nové Město, 128 00 Praha 2, které mají ve smyslu ustanovení odst. 2 § 70 zákona požádáno o podávání informací o zahajovaných řízeních.
Všem účastníkům řízení byla dána osmidenní lhůta pro seznámení se s podklady řízení a pro případné uplatnění připomínek. Této lhůty pro vyjádření se k podkladům řízení žádný z účastníků řízení nevyužil.

Výjimku dle § 43 odst. 1 lze povolit tehdy, pokud jiný veřejný zájem převažuje nad zájmem ochrany přírody, nebo v zájmu ochrany přírody nebo pokud povolovaná činnost významně neovlivní zachování stavu předmětu ochrany zvláště chráněného území.
Správní orgán vyhodnotil předložený záměr jako veřejný zájem (prohloubení dosavadních znalostí o příčinách úspěšnosti expandujícího rostlinného druhu a v obecnější rovině lepší porozumění vlastnostem, které takovou úspěšnost u rostlin umožňují). S ohledem na minimální počet návštěv území a použití šetrných metod výzkumu nelze očekávat ani zásadní ohrožení zájmů ochrany přírody v tomto území a tedy ani ovlivnění zachování stavu předmětů ochrany této NPR.
Lze tedy konstatovat, že záměr je veřejným zájmem a zároveň je i v zájmu ochrany přírody. Zjištěné informace pomohou lépe pochopit rostlinné invaze či expanze a tato problematika je v rámci ochrany přírody mimořádně důležitá. Invazní i expandující druhy rostlin se podílejí na úbytku biodiverzity a ohrožují stabilitu přirozených společenstev.

Podmínka č. 1 staní žadateli povinnost informovat správní orgán s minimálně jednodenním předstihem o návštěvách území. To umožní správnímu orgánu případnou kontrolu v terénu a také dává možnost uzpůsobit např. výběr experimentálních ploch při jejich zakládání a zohlednit např. případné hnízdění vzácnějších druhů dravců.
Podmínka č. 2 stanoví žadateli povinnost uvést místa, v nichž provozoval svou činnost do původního stavu alespoň s ohledem na přivezený materiál a odpad vzniklý v průběhu jeho aktivit.
Poskytnutí výstupů z realizovaných projektů řeší podmínka č. 3 tohoto rozhodnutí. Zaslání zprávy z výzkumu je nezbytné pro umožnění následné aplikace výstupů řešených projektů v ochranářské praxi např. při péči o chráněná území.
Poslední podmínka omezuje platnost této výjimky na období od nabytí právní moci tohoto rozhodnutí do konce roku 2019, tj. v souladu s termíny, uvedenými v žádosti o povolení výjimky.

Agentura se zabývala i otázkou, zda je splněna podmínka pro povolení výjimek ve smyslu § 45g zákona. Lokalita, do níž je záměr situován, spadá do Ptačí oblasti Soutok - Tvrdonicko a Evropsky

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významné lokality Soutok - Podluží. Správní orgán došel po zvážení všech dostupných informací k závěru, že podmínka stanovená § 45g zákona byla naplněna.
Výjimky jsou povolovány v souladu s ustanovením § 73 odst. 2 zákona, žadatelem je odborná instituce (Botanický ústav Akademie věd České republiky) a hlavním řešitelem záměru je specialista s bohatými zkušenostmi ve vědě a výzkumu (RNDr. Jindřich Chrtek, CSc.).

Agentura tedy shledala, že jsou splněny předpoklady pro povolení výjimky dle § 43 zákona a z výše uvedených důvodů bylo rozhodnuto tak, jak je uvedeno ve výroku tohoto rozhodnutí.

Poučení

Proti tomuto rozhodnutí se lze podle § 81 odst. 1 správního řádu do patnácti dnů ode dne jeho doručení odvolat k Ministerstvu životního prostředí, a to podáním učiněným u Agentury (AOPK ČR, regionální pracoviště Jižní Morava, oddělení Správa CHKO Pálava na adrese uvedené v záhlaví). V případě, že písemnost bude uložena u provozovatele poštovních služeb, lhůta pro podání odvolání se počítá ode dne převzetí rozhodnutí, nejpozději však od desátého dne ode dne jejího uložení. Odvolání je třeba podat ve třech vyhotoveních. Podané odvolání má odkladný účinek.

(*podepsáno elektronicky*)

Mgr. Jiří Kmet, v. r.

VEDOUCÍ SPRÁVY CHKO PÁLAVA

Rozdělovník:
Botanický ústav AV ČR, v.v.i., Zámek 1, 252 43, Průhonice, IČO 67985939, IDDS: 8nindrj
Město Lanžhot, Náměstí 177/2, 691 51 Lanžhot, IČO: 00283321, IDDS: 34tbc8a
Lesy ČR, s.p., LZ Židlochovice, Tyršova 1, 667 01 Židlochovice, IČO: 42196451, IDDS: e8jcfsn

NATIONALPARKVERWALTUNG PODYJÍ (THAYATAL)
PODYJÍ NATIONAL PARK ADMINISTRATION

SPRÁVA NÁRODNÍHO PARKU PODYJÍ

NA VYHLÍDCE 5, 669 01 ZNOJMO

Mgr. Tomáš Urfus, Ph.D.
Katedra botaniky PřF UK
Benátská 2
128 00 Praha

VÁŠ DOPIS ZNAČKY / ZE DNE	NAŠE ZNAČKA	VYŘIZUJE / LINKA	ZNOJMO
3. 12. 2018	SZ NPP 1390/2018 NPP 1390/2018	Zdeněk Mačát	22. 1. 2019

<u>Žádost o povolení výzkumných činností na území NP Podyjí.</u>

Vážený pane doktore,

dle vámi podané žádosti, evidované pod č. j. NPP 1390/2018, vám zasíláme informaci, že materiál kopřivy dvoudomé (*Urtica dioica*) byl na území Národního parku Podyjí odebrán v souladu s legislativními předpisy. Odběr materiálu nevyžaduje další úřední akt.

S pozdravem

Správa Národního parku 9.
PODYJÍ
Na Vyhlídce 5, Znojmo

Mgr. Lenka Reiterová
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APPENDIX VIII: *Curriculum vitae*

Ludmila Rejlová (*1990, Prague)

Contact email address: rejlovalud@gmail.com

EDUCATION

Department of Botany, Faculty of Science, Charles University

since 2016: Ph.D. study – Study programme: Botany

Thesis: Evolutionary processes shaping the genus *Urtica* L. (Urticaceae) in Europe and adjacent areas

Department of Botany, Faculty of Science, Charles University

2014–2016: M.Sc. study – Study programme: Botany

Thesis: Variation of the species *Urtica dioica* in Central Europe

Institute for Environmental Studies, Faculty of Science, Charles University

2010–2014: B.Sc. study – Study programme: Ecology and environmental protection

Thesis: The variability of the species *Urtica dioica* in the Czech Republic

EMPLOYMENT AND COLLABORATION

2020–2022: **Department of Evolutionary Plant Biology, Institute of Botany of the Czech Academy of Sciences**

Project of Pavel Trávníček (How mountains shape biodiversity: The role of the Andes in the biogeography and diversification of Earth's most species-rich orchid radiation; part-time assistance).

2017–2019: **Department of Taxonomy, Institute of Botany of the Czech Academy of Sciences**

Project of Jindřich Chrtek (Invasion vs. expansion – a mysterious origin of widespread weed *Urtica dioica* (Urticaceae), co-investigator of the project)

2017: **Department of Botany, Faculty of Science, Charles University.**

Project of Petr Sklenář (Polyploidy and reproductive strategies of alpine plants along Cordilleras in the Americas. Estimation of DNA ploidy level and genome size of plants from Argentina; part-time assistance).

2016: **Department of Botany, Faculty of Science, Charles University.**

Project of Tomáš Herben. Estimation of DNA ploidy level and genome size of plants from their original occurrence compared to plants from the cultivation conditional of the botanical garden; part-time assistance).

2016: **Department of Botany, Faculty of Science, Charles University.**

Project of Jan Prančl. Isolation and preparation of molecular samples of the genus *Batrachium*; part-time assistance).

2012–2015: **Laboratory of Flow Cytometry, Faculty of Science, Charles University.**

Technical staff.

GRANT PROJECTS

Project leader

2017–2019: The unknown origin of globally successful weed *Urtica dioica*. (Charles University Grant Agency – GAUK project no. 1206617).

Team member

2017–2019: Invasion vs. expansion – a mysterious origin of widespread weed *Urtica dioica* (Urticaceae). (The Czech Science Foundation project no. GA17-20201S).

2014–2017: Microevolutionary processes in *Sorbus aria* – an important part of understanding apomixis. (Charles University Grant Agency – GAUK project no. 1584414).

TEACHING

Lectures at Faculty of Science, Charles University:

2017–2018: Practices: Plant anatomy and morphology (MB130P35), bachelor course, two lectures in parallel – 30 students.

2016–2017: Practices: Plant anatomy and morphology (MB130P35), bachelor course, three lectures in parallel – 45 students.

SCI PUBLICATIONS

Rejlová L, Böhmová A, Chumová Z, Hořčicová Š, Josefiová J, Schmidt F-A, Trávníček P, Urfus T, Vít P, Chrtek J. 2021. Disparity between morphology and genetics in *Urtica dioica* (Urticaceae). *Botanical Journal of the Linnean Society* 195 (4): 606–621.

Trávníček P, Chumová Z, Záveská E, Hanzlíčková J, Kupková (Jankolová) L, Kučera J, Grúbová Štubňová E, **Rejlová L**, Mandáková T, Ponert J. 2021. Integrative study of genotypic and phenotypic diversity in the Eurasian orchid genus *Neotinea*. Frontiers in Plant Science 12: 734240.

Rejlová L, Chrtek J, Trávníček P, Lučanová M, Vít P, Urfus T. 2019. Polyploid evolution: The ultimate way to grasp the nettle. *Plos One* 14: e0218389.

NON-SCI PUBLICATIONS

Rejlová L & Urfus T. 2018. *Urtica kioviensis* Rogow. × *Urtica dioica* L. (J Hadinec and P Lustyk, Eds). *Additamenta ad floram Reipublicae Bohemicae XVI. Zprávy České botanické společnosti* 53: 31–112.

Kolář F, Urfus T, & **Rejlová L.** 2014. *Urtica kioviensis* Rogow. (J Hadinec and P Lustyk, Eds). *Additamenta ad floram Reipublicae Bohemicae XII. Zprávy České botanické společnosti* 49: 200–201.

CONFERENCE REPORTS

Rejlová L, Chrtek J, Trávníček P, Chumová Z, Lučanová M, Vít P, Urfus T. 2019. *Urtica dioica* complex in Europe: multi-approach insight into polyploid speciation. Fifth Conference on Plant Genome Evolution, Sitges, Spain, 2019. (poster presentation)

Rejlová L, Chrtek J, Trávníček P, Chumová Z, Lučanová M, Vít P, Urfus T. 2019. Cytogeographic pattern of *Urtica dioica* in Europe relates to morphology and habitat preferences. International Conference on Polyploidy, Ghent, Belgium, 2019. (poster presentation)

Rejlová L, Trávníček P, Urfus T. 2016. Polyploid evolution of *Urtica dioica* agg. International Conference on Polyploidy, Hybridization and Biodiversity, Rovinj, Croatia, 2016. (poster presentation)