

The hybrid between *Doronicum hungaricum* and *Doronicum orientale*: rare or overlooked?

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Abstract. Spontaneous hybrids of two *Doronicum* species, *D. hungaricum* and *D. orientale*, were found in a garden after the first year of their common cultivation. This hybrid has already been found in South Hungary and has been described as *D. ×sopiana*. The morphological characters of the hybrid with their parents were compared. Because both parental species occur in many Balkan countries, it was assumed that the hybrid is probably overlooked at localities, where both species co-occur.

Key words: *Doronicum orientale*, *Doronicum hungaricum*, *Doronicum ×sopiana*, hybridization

Introduction

Presently, interspecific hybridization is generally considered an important evolutionary factor. Stace & al. (2015) carried out the most thorough survey of the plant hybrids. It is evident that in some genera hybridization is a common phenomenon, while in others it is rare or absent. One of the genera with hybridization is *Doronicum* (Asteraceae: Senecioneae). Several hybrids are widespread as ornamental plants and have become widely naturalized. Information about hybridization in the wild is rather rare. So far, the most comprehensive paper is the one by Widder (1934). However, new data have appeared subsequently (Widder 1948, Peruzzi & al. 2012). Some hybrids are commonly cultivated, but their hybrid origin has been overlooked (e.g. Leslie 1981, Edmonson 2011, Stace 2015). Half of the hybrids reported from nature had *D. orientale* or *D. columnae* as one of the parents. Some other hybrids were found only once as, for example, *Doronicum ×sopiana* (*D. hungaricum* × *D. orientale*). This hybrid has been described

from the Mecsek Mts in South Hungary (Gáyer 1932, Horvát 1942). The first author has observed strange plants produced by cultivation of both species in his private garden in the Czech Republic. These plants were not identical with any of the other cultivated species. They were identified as the above-mentioned hybrid, *D. ×sopiana*. Such explainable origin during common cultivation in a garden has led the authors to the conclusion that this hybrid could be more common in the places of general occurrence and that it would be valuable to inform a broader audience about it. The main aim of this paper is to draw the attention of local botanists to the existence of this hybrid and to stimulate their field research.

Material and methods

Parental species and their hybrid were cultivated in the private garden of the first author at Kořenec (Czech Republic, Southern Moravia, distr. Blansko –

49°31'51"N, 16°45'3"E), at c. 600 m a.s.l. The morphology of the species was compared. *Doronicum orientale* was present as an old specimen of garden origin, *D. hungaricum* was represented by five plants originating from the area of Kováčovské Kopce Hills, South Slovakia. The latter species was planted in 2009, hybrids appeared in 2010 as young plants.

For the flow cytometric analyses, samples were processed according to the protocol of Šmarda & al. (2008) and measured on CytoFlow flow cytometer (Partec GmbH; recently Sysmex). The leaf tissues (prepared from the middle part of adult stem leaves) of both parental species and the putative hybrid were chopped and placed in a Petri dish. The relative fluorescence of nuclei has been estimated based on 5000 particles per measurement with DAPI (4',6-diamino-2-pphanylindole) fluorochrome.

Results

Parental taxa and their distribution

Doronicum hungaricum Reichenb. fil. is a perennial plant, with glabrous rhizomes with rare sericeous hairs. Its basal leaves are oblong to narrowly elliptic, narrowed to an often indistinct petiole, entire or weakly dentate. Cauline leaves are of the same shape as the basal leaves.

The plant occurs on the Balkan Peninsula and in SE of Central Europe (Álvarez Fernández 2003), with a northern distribution limit in Slovakia (Marhold & Hindák 1998), Ukraine and Moldova (Prokudin 1987; Fedorov 1994). Its habitats are mostly open forests, their margins, shrubby pastures, etc.

Doronicum orientale Hoffm. (syn.: *D. caucasicum* Bieb.) is a perennial plant, with conspicuous tufts of sericeous hairs on the rhizome. Its basal leaves are ovate-elliptic to cordate, crenate-dentate along the margin, with a distinct and long petiole. Cauline leaves are elliptic to weakly panduriform, amplexicaule, dentate.

The plant occurs (Álvarez Fernández 2003) on the Balkan Peninsula, in Italy (Ferguson 1976), but also in Turkey (especially in its western part), and in Lebanon, Syria, and Caucasus (Edmondson 1975, Mouterde 1978–1984). Its northern limit in Central Europe spreads to Hungary (Kevey 1997; Király 2009), Romania (Ciocârlan 2009), and Ukraine (Crimea: Fedorov 1994). In Austria, it is not native,

only naturalized (Fischer & al. 2008). Its habitats are forests.

It has a widespread distribution in many European countries because of common cultivation and escape (Greuter 2006+).

Both species overlap in their distribution in many countries in the Balkan Peninsula and also in Hungary (where *D. orientale* is a rare species – Kevey 1997).

Doronicum orientale and *D. hungaricum* are closely related as members of the *D. plantagineum* group (Álvarez Fernández 2003).

The hybrid and its detection

Doronicum ×*sopiana*e Gáyer et Szita in Gáyer 1932

Specimens of the putative hybrid of *D. caucasicum* × *D. hungaricum* (*D.* ×*sopiana*e) could be easily identified because of their intermediate characters (Table 1).

Rosette leaves of the hybrid are broadly elliptic, obovate to almost triangular, never cordate, with shallow teeth and a long petiole. Cauline leaves are elliptic, slightly panduriform, more similar to *D. orientale* (Figs 1, 2).

Specimens of the hybrid were stored in the Herbarium of the Masaryk University, Brno (BRNU). They are notified as a *Kořenec*, *distr. Boskovice*. *Nový kříženec*, *spontánně vzniklý na zahradě domu* čp. 75 [A new hybrid arising spontaneously in the garden of house No. 75].

While comparing the plants from the garden with photographs of *D.* ×*sopiana*e from the Mecsek Mts in Hungary (Horvát 1942 – cf. also Fig. 3),

Table 1. Distinguishing characters of *D. orientale*, *D. hungaricum* and their hybrid, *D.* ×*sopiana*e.

	<i>D. orientale</i>	<i>D.</i> × <i>sopiana</i> e	<i>D. hungaricum</i>
Rhizome	fleshy, occasionally with buds	fleshy, with buds	fleshy, thick and short, with buds
Hairs on the rhizome	with tufts of sericeous hairs at the nodes	sericeous hairs at the nodes absent	±glabrous or seldom with few present
Basal leaves	ovate-orbicular with cordate base, long-petiolate	broadly elliptic, obovate to almost triangular, never cordate	oblong to narrowly elliptical, narrowed to an indistinct petiole
Leaf margin	crenate-dentate	shallowly dentate	entire to slightly dentate
Cauline leaves	elliptic to slightly panduriform, amplexicaule, dentate	elliptic, slightly panduriform; similar to <i>D. orientale</i> ; in the original collection -obovate, dentate, with short petiole	the same shape as of basal leaves



Fig. 1. Herbarium specimens of *D. xosopiana* collected in the garden.



Fig. 2. Basal leaves of *D. hungaricum* (A), *D. xosopiana* (B), and *D. orientale* (C).

the authors have found that they differ in the shape of cauline leaves. The leaves on the photograph in the original collection are obovate, dentate, with a short petiole.

Both parental species have the same chromosome number $2n = 60$, but their genome sizes differ, the genome size of the hybrid plant being intermediate (Fig. 4).

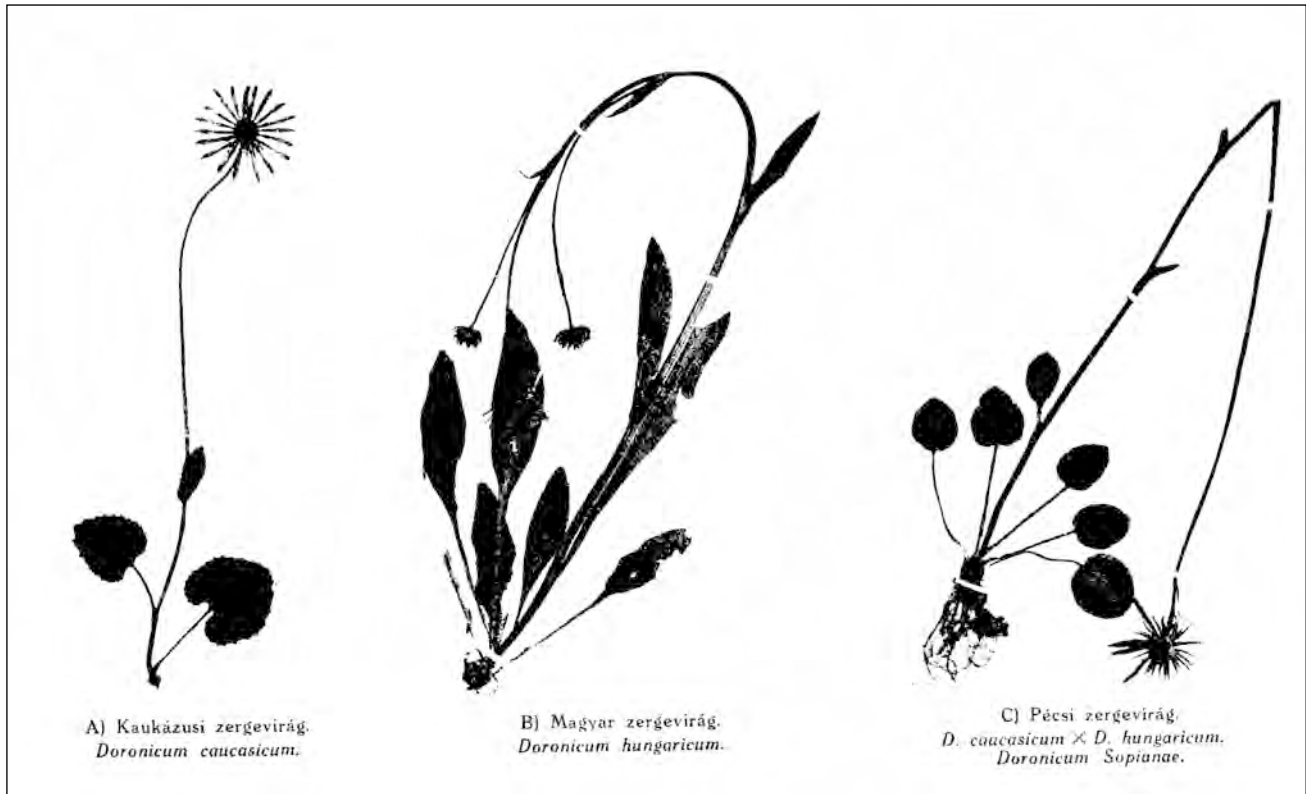


Fig. 3. Herbarium specimens of *D. orientale*, *D. hungaricum* and *D. ×sopianae* collected in Mecsek (Hungary). From Horvát (1942).

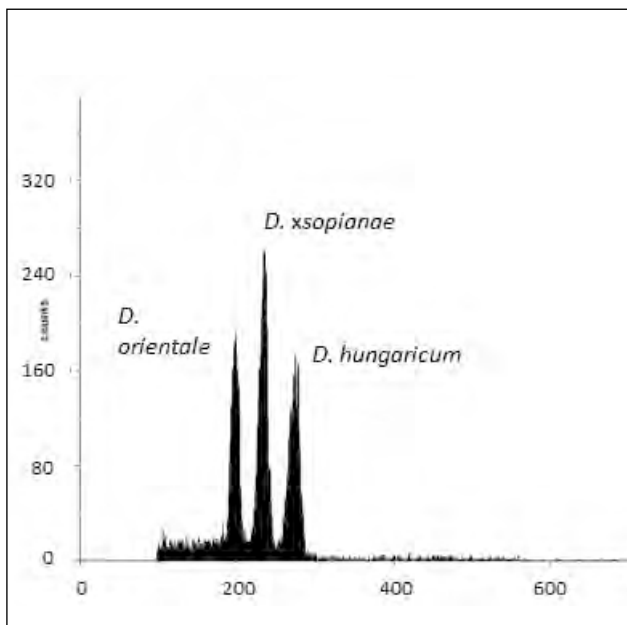


Fig. 4. FCM Diagram of *D. orientale*, *D. ×sopianae* and *D. hungaricum* (mean: 197.6, 233.4, 272.58; CV: 2.82, 2.57, 2.59).

Discussion

It is evident that, if they grow together, both species are able of spontaneous hybridization. We can only speculate, why their hybrid has been found under field conditions only once. One possible reason could be the geographical or ecological separation of both species. The overlapping of their distribution areas is not small in Serbia (Gajić 1975), Croatia (Domac 1967, Nikolić 2000, 2019), NE Greece (Dimopoulos & al. 2013), and especially in Bulgaria, where both parents have many localities (Kuzmanov 2012). Occurrence of both parents is uncertain in Slovenia, where *D. orientale* is reported by Dakskobler & al. (2011); *D. hungaricum* is absent (Martinčič & Sušnik (1984) in the *Flora and Distribution Atlas* (Jogan 2001), but is reported by Álvarez Fernández (2003). Occurrence of both species is also probable in North Macedonia (cf. Greuter 2006+).

A second reason could be the low success of hybrids, which do not survive for longer time within the populations; for that reason, their discovery might have low probability.

A third reason might be a rather wide absence of knowledge about their hybridization and thus absence of more detailed studies of their populations. If the latter is true, our paper may encourage the local botanists to study mixed populations of both species, in order to confirm or not the more common occurrence of their hybrid.

Both parents have the same number of chromosomes, $2n = 60$. Their hybrid had a DNA-ploidy level between them, so it is highly probable that it has the same chromosome number. The same chromosome number as in both parents has been reported for another hybrid of the species from the *D. plantagineum* group, namely, *D. ×minutilloii* (*D. columnae* × *D. orientale*) (Peruzzi & al. 2012).

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