VERSITA

Biologia **66**/6: 977—987, 2011
Section Botany
DOI: 10.2478/s11756-011-0111-5

Distribution of *Doronicum clusii* and *D. stiriacum* (Asteraceae) in the Alps and Carpathians

Clemens Pachschwöll[1]*, Mihai Puşcaş[2] & Peter Schönswetter[3]

[1]*Department of Systematic and Evolutionary Botany, Faculty Centre of Biodiversity, University of Vienna, Rennweg 14, A-1030 Wien, Austria; e-mail: clemens.pach@reflex.at*
[2]*Al. Borza Botanical Garden, Babeş-Bolyai University, 42 Republicii Street, 400015 Cluj-Napoca, Romania; e-mail: mihai.puscas@ubbcluj.ro*
[3]*Institute of Botany, University of Innsbruck, Sternwartestraße 15, A-6020 Innsbruck, Austria; e-mail: peter.schoenswetter@uibk.ac.at*

Abstract: In the course of a taxonomic revision of the *Doronicum clusii* agg. (Asteraceae), we present an updated and commented distribution map of *D. clusii* (All.) Tausch and *D. stiriacum* (Vill.) Dalla Torre from the Alps and Carpathians, completed with information on biogeography and taxonomy. We show that *D. stiriacum* was erroneously indicated for the Carpathians south and southeast of the Rodna Mountains in Romania and for the Western Alps. In the Western Carpathians, it has only been rarely mentioned for the Nízke Tatry (Lower Tatras) and the Belianske Tatry (Belá Tatras) in Slovakia.

Key words: *Doronicum clusii*; *Doronicum stiriacum*; Asteraceae; Alps; Carpathians

Introduction

The *Doronicum clusii* aggregate (Asteraceae) is a monophyletic group (Álvarez Fernández et al. 2001) comprising two pairs of European alpine taxa, namely *D. glaciale* (Wulf.) Nyman and *D. calcareum* Vierh. (= *D. glaciale* subsp. *calcareum* (Vierh.) Hegi) on the one hand, as well as *D. clusii* (All.) Tausch and *D. stiriacum* (Vill.) Dalla Torre (= *D. clusii* subsp. *villosum* (Beck) Vierh.[1]) on the other hand (Ehrendorfer 1973; Fischer 1994; Fischer 2008; Greuter 2008). Although both latter names are problematic from a nomenclatural point of view (Greuter 2008: 205, 797; C. Pachschwöll unpublished), we here use the binomial *D. stiriacum* following therein the two editions of the checklist of Central European vascular plants (Ehrendorfer 1967, 1973). This is in accordance with floras and checklists such as Nyárády (1964), Kucowa (1971), Fischer (1994), Marhold (1998), Mosyakin & Fedoronchuk (1999) and Ciocârlan (2009), whereas Ferguson (1976), Tasenkevich (1998), Mirek (2002), Aeschimann et al. (2004b), Fischer (2005), Oprea (2005) and Fischer (2008) treated this taxon as a subspecies of *D. clusii*.

Similarly as the majority of species in the genus *Doronicum* (Álvarez-Fernández 2003), *D. calcareum*, *D. clusii* s. str. and *D. glaciale* are diploid with $2n = 2x = 60$ (Favarger 1950; Polatschek 1961; Lovka et al. 1972; Favarger 1991; Huber & Baltisberger 1992), whereas *D. stiriacum* is tetraploid with $2n = 4x = 120$ (Wcisło 1951; Murín 1978; Tasenkevitch et al. 1989; C. Pachschwöll & H. Weiss-Schneeweiss: unpublished counts from the Eastern Alps). *Doronicum glaciale* is centred in moraines, alpine meadows and snowbeds on calcareous or intermediate bedrock whereas *D. calcareum* grows in the same vegetation types but is strictly confined to calcareous bedrock. Both species are endemics of the Eastern Alps. *Doronicum glaciale* is distributed from the Tuxer Alpen and Julijske Alpe/Alpi Giulie in the West and South to the Hochschwab massif in the East whereas *D. calcareum* is a local endemic of the north-easternmost Calcerous Alps from the Hochschwab massif to Mt. Schneeberg. *Doronicum clusii* and *D. stiriacum* are both acidophilic species of moraines, steep slopes and alpine meadows which tolerate slightly base-rich soils, but do not grow on carbonate bedrock (Aeschimann et al. 2004b; Fischer 2008; Kyak 2009; Staudinger 2009; Stöhr 2009).

In herbaria as well as in the literature, taxa of the *Doronicum clusii* agg. were often confused with each other, or with the more distantly related (Álvarez Fernández et al. 2001) *D. grandiflorum* Lam., *D. carpaticum* (Griseb. & A. Schenk) Nyman and *D. columnae* Ten.; *Doronicum carpaticum* occurs in subalpine to alpine screes, meadows, rocky slopes on lime-

[1] *D. clusii* var. *villosum* Tausch was not validly published (Greuter 2008: 797)

* Corresponding author

Table 1. Selected morphological characters distinguishing *Doronicum clusii* (All.) Tausch and *D. stiriacum* (Vill.) Dalla Torre (after Badanina 1997 and Fischer 2008, modified with own data).

	Doronicum clusii	*Doronicum stiriacum*
basal leaves	thin, tender, on the upper side almost glabrous	thicker, coarse, on both sides densely villose
glands on involucrum and scape	abundant	sparse
claws (corolla tubes) of the ray flowers	glabrous	villose
length of the corolla of the ray flowers	14.0–22.0 mm	20.0–27.0 mm
length of the corolla of the disk flowers	4.3–4.8 mm	4.7–6.0 mm
length of the pappus of the ray flowers	3.0–3.4 mm	3.4–5.4 mm
nerves of fresh young basal leaves	weakly immersed	clearly immersed
intercostal fields of fresh leaf blades	flat	slightly convex

stone and silicate and often grows along watercourses (Álvarez-Fernández 2003; Nyárády 1964). *Doronicum columnae* is a montane to subalpine plant of screes, open forests and humid, shady places on calcareous bedrock whereas *D. grandiflorum* is a subalpine to subnival species restricted to calcareous screes (Pignatti 1982; Álvarez-Fernández 2003; Aeschimann et al 2004a; Fischer 2008). *Doronicum carpaticum* and *D. columnae* differ only in their achenes, which are heteromorphic or homomorphic, respectively. Their taxonomic treatment is not clear and needs further investigation (Álvarez-Fernández 2003: 346). Selected morphological characters for distinguishing the closely related and morphologically similar *D. clusii* and *D. stiriacum* are summarised in Table 1. Due to several erroneous indications of *D. stiriacum* and *D clusii* in distribution maps (Merxmüller 1952; Meusel & Jäger 1992), revisions (Vierhapper 1900; Cavillier 1907; Álvarez-Fernández 2003), floras (e.g. Hegi 1928/1929; Nyárády 1964; Ferguson 1976) and critical checklists (Oprea 2005), our main aim was to clarify the distribution of these two species with emphasis on the Carpathians, a need already identified by Kyak (2009). We adopted a similar approach as Ronikier (2010) for *Ranunculus glacialis* L. from the Rodna and Făgăraş Mountains.

Material and methods

In order to clarify the distributions of *D. clusii* and *D. stiriacum* in the Alps and Carpathians, we revised herbarium material, conducted field research and compiled available literature. To this end, the following herbaria were consulted (acronyms according to Thiers 2010): BP, BUAG, BUCA, BVS, CL, CRAI, GZU, IAGB, IASI, IGBR, KRAM, LI, SAV, SIB, SZE, W, WU, and the private herbarium of Dr. Walter Gutermann deposited at the Faculty Centre of Biodiversity, University of Vienna. We furthermore summarised unpublished distribution data from the project IntraBioDiv (see Gugerli et al. 2008 for a project synopsis, http://intrabiodiv.vitamib.com) as well as from the project "Floristic Mapping of Austria" (in the following abbreviated as FMA; headed by Prof. Harald Niklfeld, Department of Biogeography, Faculty Centre of Biodiversity, University of Vienna, see http://www.botanik.univie.ac.at/plantchorology/atlases.htm).

Results and discussion

Erroneous Iberian indications of species of the Doronicum clusii agg.

Although *D. clusii* and even *D. glaciale* have been repeatedly reported from the Pyrenees and the Cantabrian Mountains (Willkomm & Lange 1870; Hegi 1928/29; Merxmüller 1952; Ferguson 1976; Chilton 1997), it has been long known that these are errors due to confusions with *D. grandiflorum* as well as with *D. carpetanum* subsp. *diazii* (Vierhapper 1900; Cavillier 1907; Meusel & Jäger 1992; Álvarez-Fernández 2003). Modern floras of Asturias (Mayor & Díaz 1977), Catalonia (Bolòs et al. 1990) and the Pyrenees (Saule 1991) do not mention *D. clusii* any longer.

Distribution of Doronicum clusii and D. stiriacum in the Alps

Doronicum clusii and *D. stiriacum* are two vicariant species with non-overlapping distribution ranges (Jäger & Meusel 1992: 272; Fig. 1). The Central and Western Alpine *D. clusii* is distributed almost continuously from the Alpes Ligures/Alpi Liguri and the Alpes Maritimes/Alpi Marittime (France/Italy) to the Kreuzeckgruppe (Austria). There is a distribution gap in the western parts of the Alpi Graie/Alpes Grées (Vanoise, Rutor), in the Mont Blanc as well as in the Aiguilles Rouges massif (Charpin & Jordan 1992; Fig. 1). *Doronicum clusii* has been erroneously reported for Germany, e.g. for the Berchtesgadener Alpen (Hegi 1928/29: 724). This is due to confusions with *D. glaciale*, which is known from southeastern Bavaria (Vierhapper 1900: 261, Wagenitz 1987: 1373, Rothmaler 2002: 641). One of the northernmost populations of *D. clusii* can be found on Mt. Rothornspitze (Allgäuer Alpen, Tirol, Austria), which is about 2.5 km air line distance to the German border (Gutermann 1970; Dörr 1979; Dörr & Lippert 2004). A distribution gap of about 70 km separates the easternmost population of *D. clusii* on Mt. Zietenkopf in the Kreuzeckgruppe (Kärnten, Austria; Hartl et al. 1992: 155; FMA; voucher in WU: C. Pachschwöll, clus-ZIE1, 19. 8. 2008) and the westernmost population of *D. stiriacum* on Mt. Großes Gurpitscheck (Schladminger Tauern, Salzburg, Austria; FMA; vouchers in WU: C. Pachschwöll stir-GUR2, 14. 8. 2008 as well as E. Janchen 2912, VII. 1898) in

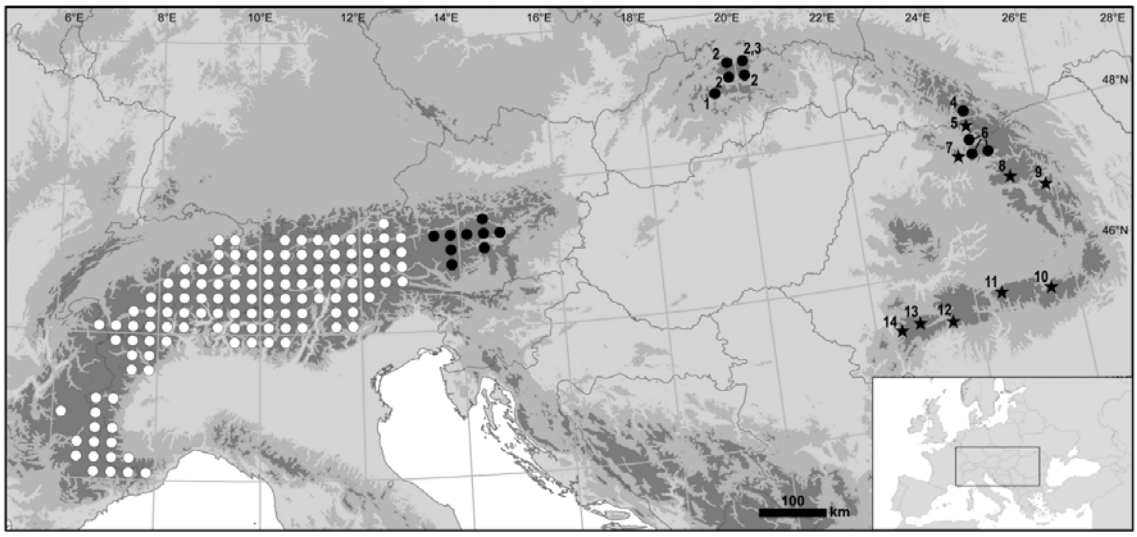

Fig. 1. Distribution of *Doronicum clusii* (white circles) and *D. stiriacum* (black circles) in the Alps and Carpathians following the IntraBioDiv grid system (Gugerli et al. 2008). Erroneous indications of *D. stiriacum* in the Carpathians are represented by black stars. Numbers correspond to the mountain ranges mentioned in the text.

spite of the ample presence of suitable geological substrates in between the two localities (Vierhapper 1935: 223).

The distribution of *Doronicum stiriacum* in Austria is well documented (herbarium specimens in Herb. Gutermann, GZU, LI, W, WU; data from FMA) and restricted to the Niedere Tauern (Schladminger Tauern, Wölzer Tauern, Rottenmanner Tauern, Triebener Tauern, Seckauer Alpen), Seetaler Alpen and Gurktaler Alpen in the federal states Salzburg, Steiermark and Kärnten (for detailed distribution maps see Hartl et al. 1992; Maurer 1998 and Wittmann et al. 1987). *Doronicum stiriacum* was repeatedly reported for the Swiss cantons Valais and Graubünden as well as for the Dauphiné e.g. in the distribution maps of Merxmüller (1952: 108) and Meusel & Jäger (1992: 496), in the Central European Flora of Hegi (1928/29: 725) or in the "Catalogue de la Flore Valaisanne" (Jaccard 1895: 200) and its "Supplementum" (Becherer 1956). With good reasons, Vierhapper (1900) and Niklfeld in Meusel & Jäger (1992: 273) already doubted the occurrences of *D. stiriacum* in the Western Alps. In the Flora of Switzerland and adjacent regions (Heß et al. 1980), *D. stiriacum* is not mentioned any longer. These indications are primarily due to confusions of *D. clusii* with *D. glaciale* (C. Pachschwöll, pers. obs.; Pignatti 1982: 116). Subsequently, Becherer (1956: 445) for unknown reasons suggested that all misidentifications of *D. glaciale* from the Swiss canton Valais in Jaccard (1895: 200) should represent *D. clusii* var. *villosum* (= *D. stiriacum*). In their distribution maps, Merxmüller (1952: 108) as well as Meusel & Jäger (1992: 496) followed this misinterpretation although it has long been known that *D. glaciale* does not reach Switzerland (Tavel 1896; Vierhapper 1900). The westernmost populations of *D. glaciale* can be found in the Tuxer Alpen, Tirol, Austria (C. Pachschwöll, pers. obs.; FMA; data from IntraBioDiv; Stöhr 2009).

Distribution of D. stiriacum in the Carpathians

In Central European Floras of the 19th century, *D. stiriacum* has often been confused with other species. Therefore, e.g. Fuss (1866: 340–343), Neilreich (1866: 115–116), Schur (1885: 339–341) and Simonkai (1886: 321–323) erroneously reported *D. glaciale* (as *Aronicum glaciale*), *D. grandiflorum* (as *A. scorpioides*) and *D. orientale* (as *D. caucasicum*) for the Romanian parts of the Carpathians. As we know today, only *D. stiriacum, D. carpaticum* und *D. columnae* grow in the alpine regions of the Carpathians. The species that was most often erroneously reported for particular mountain ranges of the Carpathians is *D. stiriacum*. In the following, we confirm or reject the presence of this species in different mountain ranges the numbering of which corresponds to the numbers in Fig. 1.

1. Nízke Tatry (Lower Tatras; Slovakia)

Doronicum stiriacum was first mentioned as *Arnica Doronicum* by Wahlenberg (1814: 273) for Mt. Ďumbier. Pax (1908: 155) regarded *D. stiriacum* (as *D. Clusii*) as a characteristic alpine saxicolous plant of the Nízke Tatry. Sillinger (1933: 284, 287, 290, 309) listed *D. stiriacum* (as *D. Clusii*) in several relevés and Álvarez-Fernández (2003: 354) mentioned it for Mt. Chopok. This is in accordance with the good documentation by herbarium specimens in BP, GZU, SAV and WU (Appendix 1). In contrast, Vierhapper (1900) and Cavillier (1907) did not indicate the taxon for the Nízke Tatry, and Dostál (1989: 1046) as well as Meusel & Jäger (1992: 496) doubted its occurrence there.

2. Tatry Zachodnie and Tatry Wysokie / Západné Tatry and Vysoké Tatry (Western Tatras and High Tatras, Poland and Slovakia)

For the High Tatras, *D. stiriacum* was mentioned first (as *Arnica Doronicum*) for Mt. Lomnický štít (Lomnitzer Spitze), Slovakia by Townson (1797: 365, 492) and subsequently by Wahlenberg (1814: 273) for the Western and the High Tatras. Since then, the occur-

rence of *D. stiriacum* has been well documented for this mountain region, where it is fairly frequent (Kotula 1889–1890: 325–326, Sagorski & Schneider 1891: 234–235, Pax 1898: 198, Vierhapper 1900: 206, Győrffy 1909, Krajina 1933, Rechinger & Scheffer 1933, Hadač 1956, Kucowa 1971: 314–315, Mirek & Piekoś-Mirkowa 1992b, Dostál 1989: 1046, Zając & Zając 2001, Kliment et al. 2010). Lists of localities can be found in Wcisło (1951: 150) for Polish Territory as well as in Vierhapper (1900: 206), Kotula (1889–1890: 325–326; as *D. hirsutum*) and in Appendix 1 for Polish and Slovakian territory. Álvarez-Fernández (2003: 354) erroneously mentioned a herbarium voucher of *D. clusii* for former Yugoslavia (YUGOSLAVIA. Visoki Verch, Liptau, July 1894, *Ullepitsch s.n.*; B) which was also cited by Greuter (2008: 205). Actually, this voucher is also from the Western Tatras: with 2176 m a.s.l., Mt. Vysoký vrch (Wysoki Wierch, Klin or Staroroboclański Wierch) is the highest peak in the Western Tatras on the border between Poland and Slovakia. The highest occurrence of *D. stiriacum* in the Carpathians is on the summit of Mt. Gerlachovský štít in the High Tatras of Slovakia in the subnival vegetation zone (Kotula 1889–1890: 325, Domin 1928: 6, Pawłowski 1931: 157; Appendix 1).

3. Belianske Tatry (Belá Tatras, Slovakia)

The presence of *D. stiriacum* in the Belianske Tatry has been overlooked by Sagorski & Schneider (1891: 234–235), Vierhapper (1900: 206), Hadač (1969, 1987), Dostál (1989: 1046) and Álvarez-Fernández (2003: 354). In contrast, Kotula (1889–1890: 325–326; as *D. hirsutum*), Domin (1926: 100–101, 1928: 18) and Petrík et al. (2006) mentioned several localities, what can be confirmed by various herbarium specimens (Appendix 1). In this mostly calcareous mountain range east of the High Tatras, *D. stiriacum* is confined to acidic bedrock such as spotted shale, marl, hornstone and quartzite (Domin 1926; Domin 1928; Petrík et al. 2006).

4. Chornohora (Ukrainian Carpathians, Ukraine)

For the Chornohora mountain range, *D. stiriacum* was first mentioned as *Aronicum Clusii* by Herbich (1860: 613) for Mt. Hutyn-Tomnatyk (as "Tomnatik") and another locality, given as "Bombiwski". Apart from the historical records of Herbich, *D. stiriacum* is known from a few other localities in this small mountain range (Appendix 1). Later, the occurrence of *D. stiriacum* in the Chornohora has been overlooked by several authors although it is mentioned for the present territory of Ukraine in Badanina et al. (1994), Badanina (1997), Čopyk (1977), Dobrochaeva et al. (1987), Gorshkova (1961, 1995), Minderova (1962), Kyak (2009), Popov (1949) and Tzvelev (1994, 2002). Due to the restricted availability of alpine habitats in the Ukrainian Carpathians, *D. stiriacum* is listed in the Red Data Books of Ukraine as "vulnerable" and "rare" respectively (Shelyag-Sosonko 1996; Kyak 2009).

5. Munţii Maramureşului (Maramureş Mountains; Romania)

Doronicum stiriacum has only been reported a single time for Vf. Farcău in the Munţii Maramureşului (Coman 1939), but in this list of montane and subalpine species, *D. carpaticum* and *D. columnae* are lacking. Later on, in an enumeration of plants from the whole Maramureş region, Coman (1946) reported *D. stiriacum* (as *D. glaciale*) from the Munţii Rodnei only, but not from the Munţii Maramureşului. Also in other floristic and geobotanical publications of this area (Coman 1938ab, Deyl 1940) *D. stiriacum* is not listed. We strongly believe that it was confused with *D. carpaticum* or *D. columnae* since the latter species is frequent in this region (Nyárády 1964, data from IntraBioDiv).

6. Munţii Rodnei (Rodna Mountains, Romania)

This is the only mountain range in Romania, where the presence of *D. stiriacum* could be confirmed. The first record for the Munţii Rodnei may be that of Baumgarten (1816: 135–136), under *Arnica Doronicum* and *Arnica glacialis*. Baumgarten's herbarium specimens from Vf. Pietrosul Mare, Vf. Ineu and Vf. Omului are stored at CL. Based upon herbarium vouchers in W, Vierhapper (1900: 206) mentioned only a single locality of *D. stiriacum* (as *D. villosum*), Vf. Ineu (as "Injen" and "Kuhhorn"). For Pax (1908: 215), *D. stiriacum* (as *D. Clusii*) represented a characteristic saxicolous plant of the Munţii Rodnei, and Ungar (1925: 475–476) regarded it as one of the rarest plants in Transylvania, which only grows on rocky slopes of this mountain range. In the Romanian Flora (Nyárády 1964: 520), several locations were given, including the highest peak Vf. Pietrosul Mare (Vf. Pietrosul Rodnei) with an elevation of 2305 m. Mititelu et al. (1989: 28) listed *D. stiriacum* in their enumeration of plants from the Pietrosul Mare reserve. In his relevés, Georghe Coldea mentioned dozens of localities where *D. stiriacum* (as *D. clusii*) grows in the alpine region of the Munţii Rodnei on acidic bedrocks like crystalline and gneiss (Coldea 1990, see also Appendix 1). *Doronicum carpaticum* is known from the Munţii Rodnei as well (Coldea 1990: 43, 44, 50, 54, 61, 70, 75, 78, Nyárády 1964: 513; data from IntraBioDiv; specimens in CL, IAGB, IASI, SIB). Both species often co-occur on the same mountains, such as on Vf. Anieşul Mare, Vf. Corongiş, Vf. Gărgălău, Vf. Ineu, Vf. Omul and Vf. Pietrosul Mare (Coldea 1990; specimens in BUCA, CL, SIB and "HBV"). Already Pax (1898: 170) was aware of the fact that only in the Munţii Rodnei and the Chornohora range, *D. stiriacum* and *D. carpaticum* can be found together. *Doronicum carpaticum* does not reach the Tatras in the West, whereas *D. stiriacum* has its southernmost Carpathian populations in the Munţii Rodnei. The occurrences of *D. stiriacum* as well as of *D. carpaticum* in the Munţii Rodnei are well documented in the herbaria BP, BUCA, CL, "HBV", IAGB, IASI, LI, SAV, SIB, W and WU (see also Appendix 1).

7. Munţii Ţibleşului (Ţibleş Mountains, Romania)

Doronicum stiriacum was first listed by Baumgarten (1816: 135) as *Arnica Doronicum* for Mt. Arszul (Vf. Arcer). Fuss (1866: 342) mentioned *Aronicum clusii* for the "Kisbányaer Alpen", the mountains around Chiuzbaia (Kisbánya), which most probably refers to the

Munţii Ţibleşului. Porcius (1878: 31) only mentioned *D. carpaticum* or *D. columnae* (as *Aronicum scorpioides*) for Mt. Arsul (Vf. Arcer) and Mt. Ciblesiu (Vf. Ţibleş). Morariu (1942) did not mention *D. stiriacum*, but Nyárády (1964: 520) listed it for Mt. Arsu (Vf. Arcer) and obviously erroneously for Gîrbova, a location at lower altitude. To our knowledge, *D. stiriacum* has never been documented for the Munţii Ţibleşului. Similarly as for the Munţii Maramureşului, confusion with the widely distributed *D. carpaticum* and *D. columnae* seems to be most probable (Nyárády 1964; data from IntraBioDiv).

8. Munţii Călimanilor (Călimani Mountains, Romania)

Neither Chirilei (1934–1935) nor Csürös (1951) mentioned *D. stiriacum* for the Munţii Călimanilor, but later on Gubesch (1969: 60) reported this species for the path between Vf. Retitis and Vf. Voivodesii. Also Mititelu et al. (1986: 29) listed it, but without exact locality or citation. The most recent checklist of the Parcul National Călimani (ICB Iaşi 1994) does not mention *D. stiriacum*, but *D. columnae* instead. Since it is known that the list of Mititelu et al. (1986) is partly based on older literature without citations and *D. stiriacum* could not be observed in the field (Gh. Coldea & M. Puşcaş 2004 and M. Puşcaş 2009, pers. obs.) nor do herbarium specimens exist, we consider it as erroneously reported for the Munţii Călimanilor. It may also be that the highest peak of the Munţii Călimanilor, Pietrosul, was confused with Pietrosul Mare, the highest peak of the Munţii Rodnei.

9. Munţii Ceahlău (Ceahlău Mountains, Romania)

Doronicum stiriacum was first mentioned for the Munţii Ceahlău in Grecescu (1906: 452) as *Aronicum Clusii*. He mentions that this plant was discovered and collected by the pharmacy student G. Zăpisescu in 1896 on humid and shady places of Mt. Ceahlău, a habitat typical for *D. carpaticum*. In the same paper, Grecescu lists and comments *D. columnae* as well as *D. carpaticum* (as *A. carpaticum*). Later studies of this mountain group (Panţu & Procopianu-Procopovivi 1901; Panţu 1911; Nyárády 1924; Grinţescu 1931) did not mention *D. stiriacum*, not even in their remarks on alpine floristic elements. Nyárády (1964: 520) reported *D. stiriacum* for the Munţii Ceahlău, but without any specific locality. Together with *D. columnae* and *D. carpaticum*, *D. stiriacum* was listed by Mititelu (1989: 60) who also included historical findings without specific citations. In Manoliu et al. (2002), *D. stiriacum* is given with a question mark, meaning that it could not be observed in recent times and may only have been erroneously reported in older literature. We could not trace herbarium specimens of *D. stiriacum* from the Munţii Ceahlău. In contrast, *D. carpaticum* is well documented from the Munţii Ceahlău in CL, IASI and W.

10. Munţii Bucegi (Bucegi Mountains, Romania)

Baumgarten (1816: 135–136) reported *D. stiriacum* (as *Arnica glacialis)* as well as *D. grandiflorum* (as *A. scorpioides*) for the Munţii Bucegi. Later, Fuss (1866: 340–343), Schur (1885: 339–341) and Simonkai (1886: 321–323) repeated these indications. Therefore, the occurrence of both species in the Munţii Bucegi is listed in Nyárády (1964: 516, 519–520), but the occurrence of *D. grandiflorum* is doubted in this work since it has never been confirmed for Romania. In the 19th century, the name *Aronicum scorpioides* var. *carpaticum* Griseb. & A. Schenk was used as a synonym for *D. carpaticum* (Griseb. & A. Schenk) Nyman, e.g. in Schur (1885: 341) which is well documented for the Munţii Bucegi with herbarium specimens in CL, IASI, LI, W and WU. In contrast, *D. stiriacum* could never be confirmed for this mountain range (Pax 1898; Pax 1908; Panţu 1907; Ungar 1913: 79, Ungar 1925: 476, Haret 1931; Domin 1933 and Beldie 1967: 277). Beldie (1967: 277) cited a herbarium voucher of *D. grandiflorum* in LW, collected by Ferdinand Schur in the Munţii Bucegi, which may be in fact *D. stiriacum*. However, since it is known that Schur often mixed up labels and locations from Transylvania with those from other regions (Soó 1962: 246), we do not consider him as a reliable source. In SAV, we found a specimen of *D. stiriacum* (as *Aronicum glaciale*) from the herbarium of Carolus Mergl collected by Gustav Moesz: "Bucsecs (Transsilvania), 1893. julius 28. Moesz." Apart from this problematic historical specimen, we could not trace any herbarium specimen of *D. stiriacum* from the floristically well explored Munţii Bucegi in all checked herbaria.

11. Munţii Făgăraşului (Făgăraş Mountains, Romania)

Fronius (1856: 127) listed *D. stiriacum* (as *Aronicum clusii*) for the Lacul Doamnei ("Domnisee"). This indication was cited by later authors like Fuss (1866: 342), Simonkai (1886: 323), Ungar (1913: 79), Nyárády (1964: 520) and Drăgulescu (2003: 359). Ungar corrected this error later on in his Flora of Transylvania (Ungar 1925: 476). Not even Nyárády (1911), who investigated the montane, subalpine and alpine flora of the Făgăraş Mountains, mentioned *D. stiriacum*. In W, we found a specimen of *D. grandiflorum* from Vf. Negoi ("In locis humidis alpinis Transsilv. in monte Negoi") collected by Schur bearing no collecting date or collection number. As pointed out in the previous chapter, we do not consider Schur's specimens as reliable sources. Also Hayek (1915: 100) believed that specimen and label did not belong together. We could neither find *D. stiriacum* near Lacul Doamnei (C. Pachschwöll, pers. obs. 2009) or in other parts of this mountain range (M. Puşcaş, pers. obs. 2010) nor could we trace any herbarium specimen of this species from the Munţii Făgăraşului. Similar as in other mountain ranges of the Southern Carpathians, *D. stiriacum* was obviously confused with the omnipresent *D. carpaticum* which is well documented from there e.g. in Nyárády (1964: 513) and Drăgulescu (2003: 359) as well as by numerous vouchers in CL, IASI, LI, SIB, W and WU.

12. Munţii Parângului (Parâng Mountains, Romania)

Fuss (1866: 342), followed by Simonkai (1886: 322), reported *D. carpaticum* (as *Aronicum carpaticum*) for the Munţii Parângului ("Paringul" and "Pareng"). In the Flora of Romania (Nyárády 1964: 520), also *D. stiriacum* was indicated for the "Munţii Parîngului" with-

out any precise location, likely due to confusion with *D. carpaticum* or *D. columnae*, which are known from there (CL; data from IntraBioDiv).

13. Munţii Retezatului (Retezat Mountains, Romania)

Doronicum stiriacum (as *Aronicum clusii*), but neither *D. carpaticum* nor *D. columnae,* was mentioned by Feichtinger (1873: 80) for Vf. Retezat. Nyárády (1958: 153) cited Feichtinger (1873) without any comments, what may imply that he has not seen *D. stiriacum* in the Munţii Retezatului himself. Schur (1885: 341) mentioned *Aronicum glaciale* for Vf. Retezat, based upon a personal communication of Albert Bielz. Simonkai (1886: 323) copied this. An almost certainly mislabelled specimen of the Eastern Alpine endemic *D. glaciale* collected by Gustav Moesz, which clearly lacks the characteristic villous hairs of *D. stiriacum* is stored at SAV ("*Aronicum glaciale*. Retyezát im Juli 1905. Moesz."). Vierhapper (1900: 206) cited a herbarium voucher from Romania: "Banat (Rochel, hb. K.)". From his distribution map on page 261, it is obvious that he meant the Munţii Retezatului, which are partly situated in the historical region of Banat. This specimen collected by Anton Rochel (herbarium Kerner in WU) does not bear additional information about its origin, but it can be seen from Kerner's personal handwriting, that he got this voucher as *Doronicum* sp. only. The specific epithet on the label was possibly added later on by Friedrich Vierhapper (W. Till, WU, pers. communication). In WU, another specimen of *D. stiriacum* collected by Rochel can be found: "*Arnica Doronicum* Jacq., V. Rg. Alp. Lipt., Rochel", meaning that is was collected in the Western Tatra Mountains, in the "Alpes Liptovenses" of the historical Liptov region. It bears a label from the second half of the 20th century: "Beleg zu A. ROCHEL: Plan. Banat. rar. (1828)", which was obviously glued onto the wrong specimen. As Anton Rochel did not mention *D. stiriacum* in his works (Rochel 1828; Rochel 1838), we are confident that Rochel's putative specimen from Banat was confused with accessions from the Tatra Mountains.

Since we could neither find *D. stiriacum* on Vf. Retezat (C. Pachschwöll, pers. obs. 2009) nor are there reliable herbarium specimens from the Munţii Retezatului, not even in the collections of Feichtinger Sándor in BP and SZE, we consider it as not present in this mountain group. Similar as in the previous cases, *D. stiriacum* was obviously confused with *D. carpaticum*, which is fairly frequent in this mountain range (C. Pachschwöll, pers. obs. 2009; herbarium specimens in CL and W; Nyárády 1958: 153; data from IntraBioDiv).

14. Munţii Ţarcu (Ţarcu Mountains, Romania)

Nyárády (1964: 520) and Boşcaiu (1971: 185), mentioned *D. stiriacum* for this mountain range, but without any precise locations. Boşcaiu (1971: 185) cited Jávorka (1925) and Prodan (1939), who gave some meanwhile outdated general information about the distribution of *D. stiriacum*. Obviously, Boşcaiu has not seen *D. stiriacum* himself in the Munţii Ţarcu. In the same book, he reported *D. columnae* and *D. carpaticum* for several locations (Boşcaiu 1971: 185, 361, 365, 376, 381). In fact, *D. columnae* and *D. carpaticum* have long been known for the Munţii Ţarcu. Already Rochel (1828: 70) mentioned them as *D. caucasicum* ("in montis Sarko"). Again, we strongly believe that *D. stiriacum* was confused with either *D. columnae* or *D. carpaticum* (vouchers in CL and W; data from IntraBioDiv).

Conclusions

Doronicum clusii s. str. is a Western and Central Alpine species distributed from the Alpi Liguri to the Hohe Tauern. Within the Alps, this is a frequent distribution pattern known from other species such as *Epilobium fleischeri* Hochst. or *Trifolium alpinum* L (Aeschimann et al. 2004a; data from IntraBioDiv). In the Carpathians, *D. stiriacum* is distributed from the Tatra Mountains in the West to the Munţii Rodnei in the East. In historical literature, it was erroneously indicated for several mountain ranges of the Eastern and Southern Carpathians in Romania. The actual distribution of *D. stiriacum* in the Carpathians corresponds with the biogeographical and floristical findings of Pax (1898: 170) and Ungar (1925: 476). For Pawłowski (1928), *D. stiriacum* (as *D. Clusii* ssp. *stiriacum*) represented an element of the *Campanula alpina*-type, but the latter species has a larger distribution range in the Eastern Alps and Carpathians, including the Southern Carpathians and mountains of the Balkan Peninsula (Ronikier et al. 2008). Also all other species Pawłowski (1928: 166) mentioned are much more widespread than *D. stiriacum*. So far, we are not aware of any other acidophilic plant with a similar distribution, spanning the easternmost Eastern Alps and the Carpathians from the Tatras to the Munţii Rodnei.

We showed that the distribution of *D. stiriacum* in Romania is restricted to the Munţii Rodnei. Maybe owing to insufficient knowledge, it was neither mentioned in recent Romanian Red Lists (Boşcaiu et al. 1994; Sârbu et al. 2007) nor in the list of vulnerable high mountain taxa in Romania (Coldea et al. 2009 in Appendix 2). In his critical catalogue of Romanian vascular plants, Oprea (2005: 378) listed *D. stiriacum* but considered it as not threatened. Due to the large extent of suitable alpine habitats in the Eastern Alps and Western Carpathians, *D. stiriacum* is not threatened there and is thus not mentioned in most Red Lists or Red Data Books of Austria, Slovakia and Poland (Mirek & Piękoś-Mirkowa 1992; Čeřovský et al. 1999; Niklfeld & Schratt-Ehrendorfer 1999; Kaźmierczakowa & Zarzycki 2001; Tasenkevich 2003; Zarzycki & Szeląg 2006). The only exception is the Red List of Slovakia (Ferákova et al. 2001), where *D. stiriacum* is treated as a species at lower risk: near threatened (LR: nt). In the current Red Data Book of Ukraine, which does not use IUCN-criteria, *D. stiriacum* is listed as a "rare" species (Kyak 2009). Similar as in the former Ukrainian Red Data Book (Shelyag-Sosonko 1996), we suggest treating this species as vulnerable (VU) in Romania following therein the guidelines of the IUCN (IUCN 2010).

This status is justified because of the restricted distribution area in Romania as well as by the fairly limited extent of alpine habitats that is expected to shrink further due to global warming (Thuiller et al. 2005; Engler et al. 2011).

Acknowledgements

This work partly was financed by a grant of the "Kommission zur Förderung und Prämierung von Diplom- und Masterarbeiten der Gesellschaft zur Förderung der Pflanzenwissenschaften" to C. Pachschwöll. M. Puşcaş was supported by the project CARPATOBIODIV (No. 32135/1.10.2008, CNMP, Romanian Ministry of Education, Research and Youth).We thank Harald Niklfeld and Thorsten Englisch for the possibility to use unpublished data from the projects "IntraBioDiv" and "Floristic Mapping of Austria". We are grateful to Walter Till (curator of WU) for comments on historical herbarium specimens and for help with loans from other herbaria, Katharina Bardy for plotting the distribution map, Manfred und Gerlinde Fischer for providing literature and translations, Walter Gutermann for nomenclatural assistance and help with historical literature, Harald Niklfeld for providing literature, translations and for correcting a draft of the manucsript, Gheorghe Coldea for help with literature and unpublished data, the curators of BP, BUAG, GZU, IASI, LI, SAV and W as well as Gheorghe Dihoru (Bucharest), Constantin Drăgulescu (Sibiu), Adrian Indreica (Braşov), Irina Irimia (Iaşi), Vladislav Kolarčik (Košice), Adrian Oprea (Iaşi), Daniel Răduţoiu (Craiova) and Michał Ronikier (Kraków) for providing photos of and information about herbarium specimens. Finally, we thank two anonymous reviewers for the comments.

References

Aeschimann D., Lauber K., Moser D.M. & Theurillat J.-P. 2004a. Flora Alpina, 1. Lycopodiaceae-Apiaceae. Haupt, Bern, 1155 pp.

Aeschimann D., Lauber K., Moser D. M. & Theurillat J.-P. 2004b. Flora Alpina, 2. Gentianaceae-Orchidaceae. Haupt, Bern, 1188 pp.

Álvarez Fernández I. 2003. Systematics of the Eurasian and North-African genus *Doronicum* (Asteraceae, Senecioneae). Ann. Missouri Bot. Gard. **90:** 319–389.

Álvarez Fernández I., Fuertes Aguilar J., Panero J. & Nieto Feliner G. 2001. A phylogenetic analysis of *Doronicum* (Asteraceae, Senecioneae) based on morphological, nuclear ribosomal (ITS), and chloroplast (trnL-F) evidence. Mol. Phylogenet. Evol. **20:** 41–64.

Badanina V.A. 1997. About species' independence of *Doronicum stiriacum* (Vill.) D.T. in the Ukrainian Flora. Ukrayins'k. Bot. Zhurn. **54:** 372–375. (In Ukrainian)

Badanina V.A., Brajon O.V. & Chopik V.I. 1994. Comparative morpho-anatomical characteristic of stem in species of genus *Doronicum* L. (Asteraceae) from Ukrainian Flora. Ukrayins'k. Bot. Zhurn. **51:** 40–47. (In Ukrainian)

Baumgarten J.C.G. 1816. Enumeratio stirpium in Magno principatu Transsilvaniae: praeprimis indigenarum in usum nostratum botanophilorum conscripta inque ordinem sexualinaturalem concinnata. 3. Libraria Camesinae, Vindobonae, 340 pp.

Becherer A. 1956. Florae Vallesiacae Supplementum. Denkschr. Schweiz. Naturf. Ges. **81:** 1–556.

Beldie A. 1967. Flora şi vegetaţia Munţilor Bucegi. Editura Academiei Republicii Socialiste România, Bucureşti, 578 pp.

Bolòs O., Vigo J., Masalles R.M. & Ninot J.M. 1990. Flora manual dels Països catalans. Editorial Pòrtic, Barcelona, 1247 pp.

Boşcaiu N. 1971. Flora şi vegetaţia Munţilor Ţarcu, Godeanu şi Cernei. Editura Academiei Republicii Socialiste România, Bucureşti, 494 pp.

Boşcaiu N., Coldea G. & Horeanu C. 1994. Lista roşie a plantelor vasculare dispărute, periclitate, vulnerabile şi rare din flora României. Ocrot. Nat. Mediului Înconj. Nat. Terra. **38:** 45–56.

Cavillier F. 1907. Étude sur les *Doronicum* à fruits homomorphes. Annuaire Conserv. Jard. Bot. Genève **10:** 177–251.

Čeřovský J., Feráková V., Holub J., Maglocký Š., Procházka F. 1999. Červená kniha ohrožených a vzácných druhů rostlin a živočichů ČR a SR. **5.** Vyšší rostliny. Príroda, Bratislava, 456 pp.

Charpin A. & Jordan D. 1992. Catalogue floristique de la Haute-Savoie. Mém. Soc. Bot. Genève **2:** 183–565.

Chilton L. 1997. Plant list of the Pyrenees. Marengo Publications, Retford, 36 pp.

Chirilei H. 1934–1935. Contribution à l'étude de la flore du district de Bârsa: Flore de la partie centrale et septentrionale du massif Călimani. Ann. Sci. Univ. Jassy. **21:** 456–467.

Ciocârlan V. 2009. Flora Ilustrată a României. Pteridophyta et Spermatophyta. Editura Ceres, Bucureşti, 1141 pp.

Coldea G. 1990. Munţii Rodnei: studiu geobotanic. Editura Academiei Române, Bucureşti, 183 pp.

Coldea G., Stoica I.-A., Puşcaş M., Ursu T., Oprea A. & The IntraBioDiv Consortium 2009. Alpine-subalpine species richness of the Romanian Carpathians and the current conservation status of rare species. Biodivers. & Conservation **18:** 1441–1458.

Coman A. 1938a. Câteva plante interesante din Maramureş. Revista Pădur. **50:** 249–250.

Coman A. 1938b. Contribuţii la flora Maramureşului. Revista Pădur. **50:** 872–873.

Coman A. 1939. Contribuţiuni la cunoaşterea florei muntelui Farcău. Revista Pădur. **51:** 1013–1014.

Coman A. 1946. Enumerarea plantelor vasculare din Maramureşul Românesc din Herbarul "A. Coman" (Continuare). Bul. Grăd. Bot. Univ. Cluj **26:** 110–130.

Čopyk V. I. 1977. Vyznačnyk roslyn Ukrains'kych Karpat (Key for determination of vascular plants in the Ukrainian Carpathians). Naukova dumka, Akademiia nauk URSR, Instytut botaniky imeni N. G. Cholodnogo, Kiev, 433 pp. (In Ukrainian)

Csürös Ş. 1951. Cercetari floristice şi de vegetaţie în Munţii Călimani. Stud. Cerc. Şti. Cluj: **1–2:** 127–143.

Deyl M. 1940. Plants, soil and climate of Pop Ivan: Synecological study from Carpathian Ukraina. Opera Bot. Čech. **2:** 1–288.

Dobrochaeva D.M., Kotov M.N., Prokudin J.N., Zaverukha V.B., Chopyk V.I., Protopopova V.V. & Krytskaya L.I. (eds) 1987. Key for determination of vascular plant species of Ukraine (Opredelitel' vyshih rasteniy Ukrainy). Naukova Dumka, Kiev.

Domin K. 1926. O vztazích vegetace tatranské k podmínkám stanoviště – Studie synekologická. Věda přír. **7:** 1–3, 33–41, 98–103, 161–177.

Domin K. 1928. Tatranská Květena. Českomoravské Podniky Tiskařske a Vydavatelské v Praze, Praha, 18 pp.

Domin K. 1933. Die Vegetationsverhältnisse des Bucegi in den rumänischen Südkarpathen. Veröff. Geobot. Inst. Rübel Zürich **10:** 96–144.

Dörr E. 1979. Flora des Allgäus. 13. Teil: Campanulaceae – Compositae (Teil 1). Ber. Bayer. Bot. Ges. **50:** 189–253.

Dörr E. & Lippert W. 2004. Flora des Allgäus und seiner Umgebung 2. IHW-Verlag, Eching bei München, 752 pp.

Dostál J. 1989. Nová květena ČSSR. **2.** Academia, Praha, 1548 pp.

Dragulescu C. 2003. Cormoflora judeţului Sibiu. Editura Pelecanus, Braşov, 503 pp.

Ehrendorfer F. (ed.) 1967. Liste der Gefäßpflanzen Mitteleuropas. Institut für Systematische Botanik der Universität Graz, Graz, 253 pp.

Ehrendorfer F. (ed.) 1973. Liste der Gefäßpflanzen Mitteleuropas. 2nd edition, Gustav Fischer Verlag, Stuttgart, 318 pp.

Engler R., Randin C., Thuiller W., Dullinger S., Zimmermann N. E., Araújo, M. B., Pearman P. B., Le Lay G., Piédallu C.,

Albert C. H., Choler P., Coldea G., de Lamo X., Dirnböck T., Gégout J.-C., Gómez-García D., Grytnes J.-A., Heegaard E., Høistad F., Nogués-Bravo D., Normand S., Puşcaş M., Sebastià M.-T., Stanisci A., Theurillat J.-P., Trivedi M., Vittoz P. & Guisan A. 2011. 21st century climate change threatens mountain flora unequally across Europe. Glob. Change Biol., 17(7): 2330–2341.

Favarger C. 1950. Polyploïdie et vicariance dans la flore alpine, Arch. d. Julius-Klaus-Stiftung **25:** 472–477.

Favarger C. 1991. Liens génétiques entre la flore orophile des Tatras et celle des Alpes à la lumière de quelques complexes polyploïdes. Polish Bot. Stud. **2:** 23–38.

Feichtinger S. 1873. Részletes Jelentés az 1872–dik évben tett társas kiránduláson észlelt fészkesekről (Compositae). Math. Term. Közlem. **10:** 77–85 .

Feráková V., Maglocký Š. & Marhold K. 2001. Červený zoznam papraďorastov a semenných rastlin Slovenska. In: Baláž D. Marhold K. & Urban P. (eds), Červený zoznam rastlín a živočíchov Slovenska. Štátna ochrana prírody Slovenskej republiky, Banská Bystrica. Ochr. Prír. **20 (Suppl.):** 44–88.

Ferguson I.K. 1976. *Doronicum* L., pp. 190–191. In: Tutin T.G., Heywood V.H., Burges N.A., Moore D.M., Valentine D.H., Walters S.M. & Webb D.A. (eds), Flora Europaea 4, Cambridge University Press, Cambridge.

Fischer M.A. (ed.) 1994. Exkursionsflora von Österreich. Ulmer, Stuttgart, 1180 pp.

Fischer M.A., Adler W. & Oswald K. 2005. Exkursionsflora von Österreich, Liechtenstein und Südtirol. 2nd ed., Land Oberösterreich, Biologiezentrum der OÖ Landesmuseen, Linz, 1373 pp.

Fischer M.A., Adler W. & Oswald K. 2008. Exkursionsflora von Österreich, Liechtenstein und Südtirol. 3rd ed., Land Oberösterreich, Biologiezentrum der OÖ Landesmuseen, Linz, 1391 pp.

Fuss M. 1866. Flora Transsilvaniae excursoria. Typ. Haeredum Georgii de Closius, Sibinii, 864 pp.

Gorshkova S.R. 1961. *Doronicum* L. In: Shishkin B.K. & Bobrov E.G. (eds), Flora of the U.S.S.R. **26:** 669–682. Akademiya Nauk SSSR, Moscow-Leningrad. (In Russian)

Gorshkova S.R. 1995. *Doronicum* L., pp. 765–782. In: Shishkin B.K. & Bobrov E.G. (eds), Flora of the U.S.S.R. 26, Bishen Singh Mahendra Pal Singh & Koeltz Scientific Books, Dehra Dun, India & Koenigstein, Germany

Grecescu D. 1906. Plantele vasculare ale Ceahlăului până acum cunoscute expuse subt raportul geografico-botanic şi sistematic. Analele Acad. Române **28:** 405–489.

Greuter W. 2008. Med-checklist: A critical inventory of vascular plants of the circum-mediterranean countries. 2: Dicotyledones (Compositae). Organisation for the Phyto-Taxonomic Investigation of the Mediterranean Area (OPTIMA), Genève, 798 pp.

Grinţescu I. 1931. La végétation du mont Ceahlău (Carpates Orientales), pp. 149–156. In: Borza A. (ed.), Guide de la sixième excursion phytogéographique internationale, Roumanie. Le jardin botanique de l'Université de Cluj, Cluj.

Gubesch L.M. 1969. Excursii botanice în munţii Călimani. Natura, Ser. Biol. **21:** 54–60.

Gugerli F., Englisch T., Niklfeld H., Tribsch A., Mirek Z., Ronikier M., Zimmermann N.E., Holderegger R., Taberlet P. & IntraBioDiv Consortium 2008. Relationships among levels of biodiversity and the relevance of intraspecific diversity in conservation – a project synopsis. Perspect. Pl. Ecol. Evol. Syst. **10:** 259–281.

Gutermann W. 1970. Drei bemerkenswerte Neufunde für das Tiroler Allgäu. Ber. Bayer. Bot. Ges. **42:** 193–197.

Győrffy I. 1909. Megjegyzések a tátrai *Doronicum Clusii* (All.) Tausch ismeretéhez (Bemerkungen zur Kenntnis von *Doronicum Clusii* (All.) Tausch aus der Hohen Tátra). Magyar Bot. Lapok. **8:** 47–50.

Hadač E. 1956. Rostlinná společentsva Temnosrečinové doliny ve Vysokých Tatrách. Biol. Práce Slov. Akad. Vied. **2/1:** 1–78.

Hadač E. 1969. Die Pflanzengesellschaften des Tales "Dolina Siedmich prameňov" in der Belaer Tatra. Vegetácia ČSSR B2, Vydavateľstvo Slovenskej Akadémie Vied, Bratislava, 343 pp.

Hadač E. 1987. Plant Ecological Notes from the Belianske Tatry Mts. Biol. Práce Slov. Akad. Vied. **33/3:** 1–95.

Haret M. 1931. La région alpine du massif des Bucegi, pp. 101–115. In: Borza A. (ed.), Guide de la sixième excursion phytogéographique internationale, Roumanie. Le jardin botanique de l'Université de Cluj, Cluj

Hartl H., Kniely G., Leute G. H., Niklfeld H. & Perko M. 1992. Verbreitungsatlas der Farn- und Blütenpflanzen Kärntens. Verlag des Naturwissenschaftlichen Vereins für Kärnten, Klagenfurt, 451 pp.

Hayek A. 1915. Über einige kritische Pflanzen der Alpenkette. II. *Doronicum Portae* Chab. Allg. Bot. Z. Syst. **21:** 97–102.

Hegi G. 1928/29. Illustrierte Flora von Mittel-Europa. VI. (2). A. Pichler's Witwe & Sohn, Wien, 1386 pp.

Heß H.E., Landolt E. & Hirzel R. 1980. Flora der Schweiz und angrenzender Gebiete, 3. Plumbaginaceae bis Compositae. 2nd edition. Birkhäuser, Basel, 876 pp.

Herbich F. 1860. Beiträge zur Flora von Galizien. Verh. Zool.-Bot. Ges. Wien **10:** 607–634.

Huber W. & Baltisberger M. 1992. IOPB chromosome data 4. Newslett. Int. Organ. Pl. Biosyst. **18/19:** 6–8.

ICB Iaşi 1994. Anexa nr.6: Lista speciilor de plante din Călimani In: Parcul Naţional Călimani – Plan de management 2008, http://www.calimani.ro/documente/Plan%20PNC.zip (accessed 19.09.2010)

IUCN Standards and Petitions Subcommittee 2010. Guidelines for Using the IUCN Red List Categories and Criteria. Version 8.0. Prepared by the Standards and Petitions Subcommittee in March 2010. http://intranet.iucn.org/webfiles/doc/SSC/RedList/RedListGuidelines.pdf (accessed 19.09. 2010)

Jaccard H. 1895. Catalogue de la Flore Valaisanne. Neue Denkschr. Allg. Schweiz. Ges. Gesammten Naturwiss. **34:** 1–472.

Jäger E.J. & Werner K. 2002. Rothmaler – Exkursionsflora von Deutschland. 4. Gefäßpflanzen: Kritischer Band. Spektrum Akademischer Verlag, Heidelberg, 948 pp.

Jávorka S. 1925. Magyar Flóra. Magyar Nemzeti Múzeum Növénytára. Studium, Budapest, 1307 pp.

Kaťmierczakowa R. & Zarzycki K. (eds) 2001. Polish Red Data Book of Plants – Pteridophytes and Flowering Plants. Polish Academy of Sciences, W. Szafer Insitute of Botany, Institute of Nature Conservation, Cracow, 664 pp.

Kliment J., Šibík J., Šibíková I., Jarolímek I., Dúbravcová Z. & Uhlířová J. 2010. High-altitude vegetation of the Western Carpathians – a syntaxonomical review. Biologia **65:** 965–989.

Kotula B. 1889–1890. Distributio plantarum vasculosarum in montibus Tatricis (Rozmieszczenie roślin naczyniowych w Tatrach), Typis universitatis Jagellonicae, Cracoviae, 213 pp.

Kucowa I. 1971. *Doronicum* L., In: Pawłowski B. & Jasiewicz A. (eds), Flora Polska **12:** 314–318. Państwowe Wydawnictwo Naukowe, Warszawa.

Krajina V. 1933. Die Pflanzengesellschaften des Mlynica-Tales in den Vysoké Tatry (Hohe Tatra). Beih. Bot. Centralbl., Abt. 2. **50:** 774–957.

Kyak V.H. 2009. *Doronicum stiriacum* (Vill.) Dalla Torre, p. 319. In: Didukh Y.P. (ed.), Red Data Book of Ukraine – Vegetable Kingdom, Izd. Globalkonsalting, Kiev, 912 pp. (In Ukrainian)

Lovka M., Sušnik F., Löve Á. & Löve D. 1972. *Doronicum glaciale* (Wulf.) Nyman, In: Löve A. (ed.): IOPB chromosome number reports XXXVI. Taxon **21:** 333–346.

Manoliu A., Zanoschi V., Coroi A.-M., Negrean G., Coroi M., Monah F. & Nechita N. 2002. Flora masivului Ceahlău, Editura Corson, Iaşi, 702 pp.

Marhold K. (ed.) 1998. Ferns and Flowering plants, pp. 333–687. In: Marhold K. & Hindák F. (eds.), Checklist of non-vascular and vascular plants of Slovakia. VEDA, Bratislava.

Maurer W. 1998. Flora der Steiermark – Verwachsenkronblättrige Blütenpflanzen (Sympetale). II/1, IHW-Verlag, Eching, 239 pp.

Mayor M. & Díaz T.E. 1977. La flora asturiana. Ayalga Ediciones, Salinas (Asturias), 710 pp.

Merxmüller H. 1952. Untersuchungen zur Sippengliederung und Arealbildung in den Alpen. I. Jahrb. Vereins Schutze Alpenpfl. Alpentiere **17:** 96–133.

Meusel H. & Jäger E.J. (eds) 1992. Vergleichende Chorologie der zentraleuropäischen Flora. 3. Karten, Literatur, Register, Fischer Verlag, Jena, 688 pp.

Minderova E.V. 1962. *Doronicum* L. In: Visjulina O.D. (ed.) Flora URSR **11:** 362–369. Vydavnyctvo Akadademiï Nauk Ukraïns'koï RSR, Kiev, 588 pp. (In Ukrainian)

Mirek Z. (ed.) 2002: Flowering plants and pteridophytes of Poland: a checklist. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków, Biodiversity of Poland **1:** 1–442.

Mirek Z. & Piękoś-Mirkowa H. 1992a. Contemporary threat to the vascular flora of the Polish Carpathians (S. Poland). Veröff. Geobot. Inst. Eidg. Techn. Hochsch. Stift. Rübel **107:** 151–162.

Mirek Z. & Piekoś-Mirkowa H. 1992b. Flora and Vegetation of the Polish Tatra Mountains. Mountain Res. Developm. **2:** 147–173.

Mititelu D. 1989. La flore vasculaire du Mont Ceahlău. Analele Şti. Univ. "Al. I. Cuza" Iaşi, Ser. Nouă, 2.a, Biol. Veget. Supliment **35:** 55–63.

Mititelu D., Axinte S. & Dorca M. 1989. La flore et la végétation de la réserve de Pietrosul Rodnei. Analele Şti. Univ. "Al. I. Cuza" Iaşi, Ser. Nouă, 2.a, Biol. Veget. **35:** 27–31.

Mititelu D., Viţalariu G., Chifu T. Ştefan N., Dăscălescu D. & Horeanu C. 1986. Flora Munţilor Călimani. Analele Şti. Univ. "Al. I. Cuza" Iaşi, Ser. Nouă, 2.a, Biol. Veget. Supliment **32:** 28–30.

Morariu I. 1942. Vegetaţia Muntelui Ţibleş (Schiţă geobotanică). Bul. Soc. Rom. Geogr. **61:** 143–180.

Mosyakin S.L. & Fedoronchuk M.M. 1999. Vascular plants of Ukraine: a nomenclatural checklist. National Academy of Sciences of Ukraine, M. G. Kholodny Institute of Botany, Kiev, 345 pp.

Murín A. 1978. *Doronicum stiriacum* (Vill.) D.T. In: Májovský J. (ed.), Index of chromosome numbers of Slovakian Flora (Part 6). Acta Fac. Rerum Nat. Univ. Comen. Bot. **26:** 23

Neilreich A. 1866. Aufzählung der in Ungarn und Slavonien bisher beobachteten Gefässpflanzen nebst einer pflanzengeografischen Uebersicht. Wilhelm Braumüller, Wien, 389 pp.

Niklfeld H. & Schratt-Ehrendorfer L. 1999. Farn- und Blütenpflanzen, pp. 33–152. In: Niklfeld H. (ed.), Rote Listen gefährdeter Pflanzen Österreichs. Grüne Reihe des Bundesministeriums für Umwelt, Jugend und Familie 10, Austria Medien Service GmBH, Graz.

Nyárády E.G. 1911. Kirándulás a Fogarasi Havasokba (Ausflug in das Fogaraser Hochgebirge). Magyar Bot. Lapok **10:** 77–83.

Nyárády E.I. 1924. Contribuţiuni la cunoaşterea vegetaţiei şi florei muntelui Ceahlău. Bul. Inform. Grăd. Bot. Univ. Cluj. **4:** 79–88.

Nyárády E.I. 1958. Flora şi vegetaţia munţilor Retezat. Editura Academiei Republicii Populare Romîne, Bucureşti, 195 pp.

Nyárády E.I. 1964. *Doronicum* L. In: Săvulescu T. (ed.), Flora Republicii Populare Romîne, Editura Academiei Republicii Populare Romîne, Bucureşti, **9:** 506–520.

Oprea A. 2005. Lista critică a plantelor vasculare din România. Ed. Univ. "Alexandru Ioan Cuza", Iaşi, 668 pp.

Panţu Z.C. 1907. Contribuţiune la Flora Bucegilor. Analele Acad. Române, ser. 2, **29:** 281–312.

Panţu Z.C. 1911. Contribuţiuni nouă la Flora Ceahlăului. Analele Acad. Române, ser. 2, **33:** 293–346.

Panţu Z.C. & Procopianu-Procopovici A. 1901. Contribuţiuni la Flora Ceahlăului. I. Regiunea alpină şi subalpină. Bul. Erb. Inst. Bot. Bucureşti **1:** 80–131.

Porcius F. 1878. Enumeratio plantarum phanerogamicarum districtus quondam Naszódiensis. Nic. K. Papp, Claudiopoli, 64 pp.

Pawłowski B. 1929. Die geographischen Elemente und die Herkunft der Flora der subnivalen Vegetationsstufe im Tatra-Gebirge. Bull. Int. Acad. Polon. Sci., Cl. Sci. Math. Sér. B 1 Bot. **1928:** 161–202.

Pawłowski B. 1931. Maksima wysokościowe kilkudziesięciu roślin tatrzańskich. Spraw. Komis. Fizjogr. **65:** 153–158.

Pax F. 1898. Grundzüge der Pflanzenverbreitung in den Karpathen I. In: Engler A. & Drude O. (eds), Die Vegetation der Erde. Sammlung pflanzengeographischer Monographien II. Verlag von Wilhelm Engelmann, Leipzig, 269 pp.

Pax F. 1908. Grundzüge der Pflanzenverbreitung in den Karpathen II. In: Engler A. & Drude O. (eds), Die Vegetation der Erde. Sammlung pflanzengeographischer Monographien X. Verlag von Wilhelm Engelmann, Leipzig, 321 pp.

Petrík A., Dúbravcová Z., Jarolímek I., Kliment J., Šibík J. & Valachovič M. 2006. Syntaxonomy and ecology of plant communities of the *Carici rupestris-Kobresietea bellardii* in the Western Carpathians. Biologia **61:** 393–412.

Pignatti S. 1982. Flora d'Italia. 3. Edagricole, Bologna, 780 pp.

Polatschek A. 1966. Cytotaxonomische Beiträge zur Flora der Ostalpenländer II. Österr. Bot. Z. **113:** 101–147.

Popov M.G. 1949. Očerk rastitel'nosti i flory Karpat (Sketch of the vegetation and flora of the Carpathians). Izdatel'stvo Moskovskogo obščestva ispytatelej prirody, Moskva. Mater. Pozn. Fauny Fl. S.S.S.R., Otd. Bot. **13:** 1–302. (In Russian)

Prodan I. 1939. Flora pentru determinarea şi descrierea plantelor ce cresc în România, I-II. Tipogr. Cartea Românească, Cluj

Rechinger K.H. & Scheffer J. 1933. Zur Kenntnis der Flora und Vegetation der Liptauer Alpen (Zentralkarpathen). Repert. Spec. Nov. Regni Veg. **31:** 284–312, 337–357.

Rochel A. 1828. Plantae Banatus rariores, iconibus et descriptionibus illustratae. Landerer de Füskút, Pestini, 84 pp.

Rochel A. 1838. Botanische Reise in das Banat im Jahre 1835. Gustav Heckenast, Pesth, 90 pp.

Ronikier M. 2010. Distribution of the arctic-alpine *Ranunculus glacialis* (Ranunculaceae) in the Carpathians, with a new locality in the Făgăraş Mountains (Romania). Polish Bot. J. **55:** 199–207.

Ronikier M., Cieślak E. & Korbecka G. 2008. High genetic differentiation in the alpine plant *Campanula alpina* Jacq. (Campanulaceae): evidence for glacial survival in several Carpathian regions and long-term isolation between the Carpathians and the Alps. Mol. Ecol. **17:** 1763–1775.

Sagorski E. & Schneider G. 1891. Flora der Centralcarpathen II. Verlag von Eduard Kummer, Leipzig, 591 pp.

Saule M. 1991. La grande flore illustrée des Pyrénées. Editions Milan, Toulouse, 765 pp.

Sârbu A., Sârbu I., Oprea A., Negrean G., Cristea V., Coldea G., Cristurean I., Popescu G., Oroian S., Tănase C., Bartok K., Gafta D., Anastasiu P., Crişan F., Costache I., Goia I., Maruşca T., Oţel V., Sămărghiţan M., Hentea S., Pascale G., Răduţoiu D., Baz A., Boruz V., Puşcaş M., Hiriţiu M., Stan I. & Frink J. 2007. Arii Speciale pentru Protecţia şi Conservarea Plantelor în România, Editura Victor B. Victor, Bucureşti, 396 pp.

Schur J.F. 1885. Enumeratio plantarum Transsilvaniae, exhibens stirpes phanerogamas sponte crescentes atque frequentius cultas, cryptogamas vasculares, characeas, etiam muscos hepaticasque. Braumüller, Vindobonae, 984 pp.

Shelyag-Sosonko Y.R. (ed.) 1996. Red Data Book of Ukraine: Plants. Ukrayins'ka Entsyklopediya Press, Kiev. (In Ukrainian)

Sillinger P. 1933. Monografická studie o vegetaci Nízkých Tater. Orbis, Praha, 339 pp.

Simonkai L. 1886. Erdely edényes flórájának helyes bitett foglalata (Enumeratio florae Transsilvanicae vasculosae critica). Kiadja a Kir. Magyar Természettudományi Társulat, Budapest, 678 pp.

Soó R. 1962. Schlusswort zur Diskussion über die Flora RPR (Erwiderung an Herrn Akad. E. I. Nyárády). Ann. Univ. Sci. Budapest. Rolando Eötvös, Sect. Biol. **5:** 243–247.

Staudinger M. 2009. *Doronicum glaciale* (Wulf.) Nyman subsp. *calcareum* (Vierh.) Hegi, pp. 124–125. In: Rabitsch W. & Essl F. (eds), Endemiten – Kostbarkeiten in Österreichs Pflanzen- und Tierwelt. Naturwissenschaftlicher Verein für Kärnten, Klagenfurt, 923 pp.

Stöhr O. 2009. *Doronicum glaciale* (Wulf.) Nyman subsp. *glaciale*, pp. 125–127, In: Rabitsch W. & Essl F. (eds), Endemiten – Kostbarkeiten in Österreichs Pflanzen- und Tierwelt. Naturwissenschaftlicher Verein für Kärnten, Klagenfurt, 923 pp.

Tasenkevich L. 1998. Flora of the Carpathians. Checklist of the native vascular plant species. State Museum of Natural History of the National Academy of Sciences of Ukraine, L'viv, 609 pp.

Tasenkevich L. 2003. Vascular Plants, pp. 6–19. In: Witkowski Z.J., Król W. & Solarz W. (eds), Carpathian List of Endangered Species. WWF and Institute of Nature Conservation, Polish Academy of Sciences, Vienna-Krakow, http://www.carpates.org/docs/publications/list.indd.pdf (accessed 20.01.2011).

Tasenkevich L., Vysotskaja E.I. & Vorobetz N.K. 1989. Chromosome numbers in rare and endemic species of vascular plants from the Ukrainian Carpathians. Bot. Zhurn. (Moscow & Leningrad) **74:** 1669–1670. (In Russian)

Tavel F. 1896. Mittheilungen aus dem botanischen Museum des eidgenössischen Polytechnikums in Zürich: *Aronicum glaciale* (Wulf.) Rchb.. Ber. Schweiz. Bot. Ges. **6:** 39–52.

Thiers B. 2010. Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. http://sweetgum.nybg.org/ih/ (accessed 19.09.2010)

Thuiller W., Lavorel S., Araújo M.B., Sykes M.T. & Prentice I. C. 2005. Climate change threats to plant diversity in Europe. Proc. Natl. Acad. Sci. U.S.A. **102:** 8245–8250.

Townson R. 1797. Travels in Hungary with a short account of Vienna in the year 1793. G.G. and J. Robinson, London, 506 pp.

Tzvelev N.N. (ed.) 1994. Flora Europeiskoi chasti SSSR (Flora partis Europaeae URSS). VII. Izdat. Nauka Leningradskoe Otd., Leningrad, 318 pp. (In Russian)

Tzvelev N.N. (ed.) 2002. Flora of Russia – The European Part and bordering regions. VII. Balkema, Rotterdam, 456 pp.

Ungar K. 1913. Die Alpenflora der Südkarpathen. Jos. Drotleff, Hermannstadt, 92 pp.

Ungar K. 1925. Die Flora Siebenbürgens. Jos. Drotleff, Hermannstadt, 535 pp.

Vierhapper F. 1900. "*Arnica Doronicum* Jacquin" und ihre nächsten Verwandten. Oesterr. Bot. Z. **50:** 109–115, 173–178, 202–208, 257–264, 501.

Vierhapper F. 1935. Vorarbeiten zu einer pflanzengeographischen Karte Österreichs XIV. Vegetation und Flora des Lungau (Salzburg). Abh. Zool.-Bot. Ges. Österreich **16:** 1–289.

Wahlenberg G. 1814. Flora Carpatorum principalium exhibens plantas in montibus Carpaticis inter flumina Waagum et Dunajetz eorumque ramos Arvam et Popradum crescentes, cui praemittitur Tractatus de altidudine, vegetatione, temperatura et meteoris horum montium in genere. Vandenhöck et Ruprecht, Gottingae, 408 pp.

Wagenitz G. (ed.) 1987. Illustrierte Flora von Mitteleuropa. 2nd edition, VI (4). Compositae II: Matricaria – Hieracium, Parey, Berlin, 912 pp.

Wcisło H. 1952. Cytological and embryological studies in *Doronicum* L. Bull. Int. Acad. Polon. Sci., Cl. Sci. Math. Sér. B 1 Bot. **1951:** 147–166.

Willkomm H.M. & Lange J.M.C. 1870. Prodromus florae hispanicae, 2. Schweizerbart, Stuttgart, 680 pp.

Wittmann H., Siebenbrunner A., Pils P. & Heiselmayer P. 1987. Verbreitungsatlas der Salzburger Gefäßpflanzen. Sauteria **2:** 1–403.

Zając A. & Zając M. (eds) 2001. Distribution atlas of vascular plants in Poland. Laboratory of Computer Chorology, Institute of Botany, Jagiellonian University, Cracow, 714 pp.

Zarzycki K. & Szeląg Z. 2006. Red list of vascular plants in Poland, pp. 9–20. In: Red List of Plants and fungi in Poland. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.

Received October 22, 2010
Accepted February 11, 2011

Appendix 1: List of Carpathian localities of *Doronicum stiriacum*

N.B.: Current names of toponyms or comments referring to the original labels are given in square brackets.

Nízke Tatry (Lower Tatras; Slovakia):

Chopok (2023 m a.s.l.): Demänovská Dolina: severný svah Chopku, 2024 m, 22. VII. 1955, leg et det. Ščevka s.n. (SAV); Comit. Zólyom: in m. Chopoc [Chopok], 20. VI. 1928, B. Lengyel, 233603 (BP).

Ďumbier (2043 m a.s.l.): In m. Gyömbér [Ďumbier], ca. 2000 m, 8. VIII. 1927, B. Lengyel, 233592 (BP); In alpinus montis Gyömbér [Ďumbier] supra pagum Zólyombrézó [Podbrezová], 14. Jul. 1914, L. Thaisz, 174338 (BP); Ďumbier, 2000 m, VII. '36, Nábělek s.n. (SAV); Brezno, Ďumbier, 16. VII. 1896, leg. Sámuel Kupčok, s.n. (GZU); Northern side of Mt. Ďumbier: steep slope with humid alpine grassland, grass patches (width 3–6 metres) between 2 moraine fields with big blocks of granite, appr. 0,9 km NE of Ďumbier peak, alt. 1710 m, 19°38′06″E, 48°56′25″N, 27. 08. 2009, leg. Vladislav Kolarčik, det. Clemens Pachschwöll, stir-DUM1 (WU)

Skalka (1980 m a.s.l.): Montes Prasiva [Prašivá]: in m. Skalka, 6. VIII. 1929, B. Lengyel, 273220 (BP)

Tatry Zachodnie (Western Tatras; Poland):

Kasprowy Wierch [Kasprov vrch]: Skrajna Turnia [Krajná kopa] – gegen die Świnica [Svinica]; 1955–2130 m, 11.08.2001, leg. et det. P. Schönswetter & A. Tribsch, 19°59′50"E, 49°13′25"N, 7003 (WU); Pyszna, 4. VII. 1924, leg. W. Heitzmann, 010688 (KRAM); Tatry granitowe, w dziedzinie alpejskiej. Stoki Świnnicy [Svinica] ku Liliowemu [Ľaliové sedlo], 12.VIII.1911, Zb. St. Zuber, 115759 (CL) as well as 178632 (KRAM); Na szczycie Blyszcza, ok. 2000 m, 29. VIII. [sine anno], H. Czeczotowa, 038842 (KRAM); Murawy. Zbocze Beskidu od str. Hali Gąsienicowej, 29. 7. [19]52, leg. Staszkiewicz, 406965 (KRAM); Twardy Upłaz, 1920 m, Skały granitowe, 14. VII. 1942, lg./det. R. Ochyra, 226977 (KRAM).

Západné Tatry (Western Tatras, Slovakia):

Liptauer Alpen, Rohace, 1700 m, feuchte Felsspalten, 14. 8. [19]05, F. Pax, 174374 (BP); Rohač-Seen [Roháčske plesá] 1600 m, Smutná dolina 1600–1900 m, Spálená dolina 1600 m (Rechinger & Scheffer 1933: 351).

Murín (1978) published two chromosome counts ($2n = 120$) from Mt. Baranec and Smutná dolina.

Tatry Wysokie (High Tatras, Poland):

Morskie Oko, Seeufer und mit Blockschuttmaterial aus Kristallingesteinen verkleidete Unterhänge zum See, 1393–1500 m, 8. Juli 1993, leg. et det. A. Drescher, 204327 (GZU); Plantae Poloniae Exsiccatae, 484. *Doronicum clusii* (All.) Tausch var. *villosum* Tausch, ad lacum Czarny Staw Gąsienicowy vergens, locis graminosis, 6.VII.1952, leg. W. Wróblówna, Z. Wiśniewska, K. Kostrakiewicz, H. Błaszczyk, det. T. Tacik, 063640 (GZU) as well as 185159 (KRAM); Galizien, Tatra, Poduplaski-Tal [Dolina Białej Wody, Dolina pod Wysoką], ca. 1800 m, 9. VIII. 1909, leg. et det. F. Vierhapper, 2446 (WU); Dolina Pańszczycy, 1540 m, 18. VI. 1961, lg. H. Piękoś, 088448 (KRAM); Tatry, dziedzina alpejska na granitach. Kocioł pod Mieguszowieckim, 07. 1911, Zb. M. Raciborski i A. Żmuda, 115758 (CL), 016472 (GZU) as well as 178631 (KRAM); Kościelec, 22. VIII. 1954, lg. M. Sychowa, det. H. Piękoś, 038841 (KRAM); Wielka Galeria Cubryńska, skały granitowe na ścianie Mięguszowieckiego

Wielkiego, 31. VIII. 1954, lg. A. Jasiewicz, 415396 (KRAM); Dolina Gąsienicowa, skały na SE od Czarnego Stawu, 7–19–1955, [lg. T. Traczyk?], 542200 (KRAM); In saxosis graniticis in latere septentr.-occid. Rysy supra lacum Czarny Staw, 2035 m, 3. IX. 1938, leg. et det. J. Mądalski, 178628 (KRAM).

Vysoké Tatry (High Tatras, Slovakia):

Rysy, 2300 m, 9. VII. 1938, leg. et det. Ing. K. Ptačovský, s.n. (SAV); Ober dem Poppersee [Popradské pleso], 19 Juli [1]901, Herbarium Paul Conrath Inv. H. Nr. 132 (GZU); Bialkatal [Dolina Bialky] an der Mündung des Roztokatales [Roztocká dolina], 8. VII. 1918, leg. K. Ronniger, 2310 (W); S crest of Czarny Szczyt [Čierny Štít] peak, alpine meadow on granite, alt. 2315 m, N 49°12′19″, E 20°12′09″, 05. 09. 2008, leg. et det. A. & M. Ronikier, stir-SZC1 (WU); Gerlach [Gerlachovský štít], leg. et det. Futák, Hubová, s.n. (SAV); Lomnický štít, 29. VII. 1941, leg. et det. Dr. Fr. Nábělek, s.n. (SAV); Kriváň, 12.7.1943, leg. et det. F. Nábělek (SAV); Velická Dolina, ca. 1850 m, 8.8.1962, leg et det. J. Futák, s.n. (SAV); Felkai völgy [Velická dolina], Langer See [Dlhé pleso velické], 18.08.1904, leg. Győrffy, 160697 (CL), as well as mentioned in Győrffy (1909: 50); Flora Hungarica exsiccata, Cent. VIII., Angiospermae 519, 790. *Doronicum stiriacum* (Vill.) Dalla Torre, Comit. Szepes [Spiš], montes Magas Tatra [Vysoké Tatry], In glareosis graniticis ad lacum „Késmárki Zöld-tó“ [Zelené pleso Kežmarské], 1500 m, 26. Jun. 1915, leg. J.B. Kümmerle et Gy. Timkó, 8418 (W), 2889 (WU) as well as 424770 (CL); in alpinis ad lacum Hyncovo [Hincovo] pleso; 1965 m., VIII. 1934, leg. J. Šmarda, 3039 (WU) as well as 440948 (CL); bei den 5 Seen [Päť Spišských plies] im Kohlbachtal [Studená dolina], Tatra Südseite, Aug. 1910, 2726, J. Nevole (WU); In valle alpina “Kis-Tarpatak” [Malá Studená dolina] Tatrae Magnae loco “Öttò” [Päť spišských plies] dicto, 29.08.1908, L. de Thaisz, 93072 (CL); opp. Starý Smokovec: in vicinitate casae “Brnčálová chata”, 8.7.1991, leg. V. Žíla, 217934 (LI); In valle Mlynica [Mlynická dolina], alt. 1350–1700 m, 17 Jun [1]928, leg. prof. dr. Al. Borza, 157163 (CL); Mlynická dolina, Furkotská dolina, 7. 8. [19]99, leg. et det.: R. Letz, s.n. (SAV);

Mlynická dolina: various localities (Krajina 1933)

Temnosmrečinská dolina: various localities (Hadač 1956)

Belianske Tatry (Belá Tatras; Slovakia)

Bujačí vrch (1947 m a.s.l.): Bujačí, 1750 m, 12. VII. 1954, leg. et det. J. Futák, s.n. (SAV); in monte Stirnberg [Bujačí vrch], alt. ca. 1700 m. s.m., 23. VII. 1918, J. Andrasovszky, 395944 (BP)

Hlúpy vrch (2061 m a.s.l.): An den Abhängen des Törichten Gern [Hlúpy vrch] gegen den Kopapass [Kopské sedlo], 24. VII. 1912, leg. Dr. Korb, det. Vierhapper 1913, 1955/7880 (W). Petrík et al. (2006) also mentioned localities from this peak: Table 3: relevées 29–31, 34–35. Domin (1926: 100–101) indicated *D. stiriacum* (as *Aronicum Clusii*) for Hlúpy vrch, growing between boulders on quartzitic bedrock.

Ždiarska vidla (2142 m a.s.l.): Petrík et al. (2006): Table 2: relevée 32, Table 3: relevée 27, Table 4: relevée 10

Havran (2152 m a.s.l.): Petrík et al. (2006): Table 2, relevée 21

Chornohora (Ukrainian Carpathians; Ukraine)

Hoverla (2061 m a.s.l.):

In alp. Hoverla ad Jasina [Yasinia], ca. 2100 m, 21. VII. 1928, leg. A. Margittai, 484433 (BP)

Pop Ivan, Pip Ivan Chornohirs'kyi (2022 m a.s.l.): In some maps, this peak is called Chorno Hora only. Popov (1949: 246), Tasenkevich et al. (1989: 1670), Badanina et al. (1994: 41) and Kyak (2009) mentioned *D. stiriacum* for this peak. In Tasenkevitch et al. (1989), the only chromosome count ($2n = 120$) from the Eastern Carpathians can be found.

Čorná Hora, Pop Ivan, 2000 m, 26. VII. 1933, without collector, s.n. (SAV); Pop Iwan w Czarnej Horze, pod szczytem na pochyłości skalistej, A. Sleńdziński, 27/8/1875, 178653 (KRAM); Pop Iwan, Cz. Hora, zebrał: Dr. H. Zapałowicz, 27/7/1881, 178650 (KRAM).

Rebra, Sebra (2001 m a.s.l.): Badanina et al. (1994: 41) and Kyak (2009) mentioned *D. stiriacum* for this peak, growing there in the alpine zone on rocky slopes.

Czarnohora – Gadżyna [a locality between Rebra and Shpytsy]: na piargach stok pn., wys. ± 1675 m, 29. VII. 1934, lg. A. Środoń, 010884 (KRAM)

Špyci, Shpytsy, Shpycy (1863 m a.s.l.): Kyak (2009)

Brebeneskul (2035 m a.s.l.): Kyak (2009); Czarnohora, Brebenieskuł, pod szczytem, 8. VIII. 1935, A. Środoń, 010884 (KRAM).

Munčel, Munchel (1998 m a.s.l.): Kyak (2009)

Hutyn, Hutin, Hutin-Tomnatyk (2018 m a.s.l.): Kyak (2009)

Munţii Rodnei (Rodna Mountains; Romania)

Vf. Pietrosul Rodnei, Vf. Pietrosul Mare (2305 m a.s.l.): upper part of Iezer glacial cirque, under Pietros Peak (Rodna Mts), humid rocks, cristalline schist, N slope, 2100 m, 24°38′17.00″E, 47°35′43.30″N, 26.8.2008, leg. et det. Mihai Puşcaş, stir-PIE1 (WU); Pietrosul Mare, roci cristaline, Alt. cca. 2000 m, 9.VIII.1986, leg. Gh. Groza, 216525 (LI); Verfu Pietroszu [Vârful Pietrosul], Nordabhang, westlicher Kessel, Glimmerschiefer, 2300 m, Felsspalten, 5. 8. [19]04, F. Pax, 174351 (BP); Vrf. Pietrosu [Vârful Pietrosul] bei Borsa [Borşa], um den Gipfel (2305 m) in feuchten Felsspalten, 2.VIII.1909, leg. F. Vierhapper, 9468 (W) as well as 2446 (WU).

Vf. Ineu (2279 m a.s.l.): In alpe Ünőkő [Vf. Ineu] supra pagum Radnaborbereki [Valea Vinului] in herbidis, 20.VIII. 1942, alt. cca. 2100 m, leg. et det. Zoltan Kárpáti, 395941 (BP); in monte Ineu, in boreali alpium tractu, substratu gneissico, alt. 6000 ped, Die 20 Jul. 1850, legit. Th. Kotschy, s.n. (W); Rodnaer Alpen, Kühhorn [Kuhhorn, Vf. Ineu], 7700 Fuß, July [1]855, Wolff, 6804 (W); Ineu bei Rodna, ca. 2200 m, feuchte Gesteinsfluren, 31.VII.1909, leg. F. Vierhapper, 2446 (WU); Transsilvania, distr. Bistriţa-Năsăud. In monte Ineu supra balneas Valea Vinului. alt. cca 1900–2280 m.s.m., 21. August 1923, leg. dr. Al. Borza, 502217 (CL).

Vf. Cişa (2036 m a.s.l.): In rupestris graminosis ad cacumen montis Cisia [Vf. Cişa] propre pagum Radna-Borberek [Valea Vinului], 22.VIII.1904, leg. Dr. J. Béla Kümmerle, 174344 (BP).

Vf. Buhăiescu (2221 m a.s.l.): Buhăiescu (M-ţii Rodnei), stânci înierbate, 28.07.2001, leg. et det. Mihai Puşcaş, 659986 (CL).

Vf. Laptelui (2172 m a.s.l.): Mtii Rodna pe Vf. Laptelui, 09.08.1958, leg. A. Nyárády, 117162 (SIB).

Poarta lui Beneş (ca. 1800 m a.s.l.): Montes Radnenses Transsilvaniae in rupibus calcareis sub Portam [Poarta lui Beneş, Poarta Corongişului]: inter montes Száka [Saca] et Kis Korongyis [Corongişul Mic], 14.08.1941, A. Nyárády – Szücs L., 201887 (CL).

Other localities, where *D. stiriacum* was reported (as. *D. clusii*) for the Munţii Rodnei by Coldea (1990: 35, 37, 44, 46, 56, 62, 64) are: Căldarea Bila-Ineu, 1650 m; Vf. Gărgălău, 1930–2110 m; Vf. Anieşul Mare, 2050–2100 m; Vf. Anieşul Mic, 2070 m; Vf. Omul, 2050 m; Vf. Momaia, 2000 m; Vf. Piatra Albă, 1850–2100 m; Vf. Anieş, 2000 m; Vf. Puzdra, 2120 m; Vf. Clăilor, 2050 m.