

## Typification and distribution of two hybrids of *Juniperus communis* L.

Álvaro Enríquez-de-Salamanca

Department of Biodiversity, Ecology and Evolution, Complutense University of Madrid, 28040 Madrid, Spain, alvenriq@ucm.es

### ABSTRACT

The common juniper (*Juniperus communis* L.) is a widely distributed species in the northern hemisphere, with numerous infraspecific taxa proposed over time. Eight groups are currently recognized, three of them occurring in Europe and the Mediterranean; they are considered as species, subspecies or varieties, with the country of origin of the taxonomists having a strong influence on this decision. Introgessions and hybrids have been recognized among some of these infraspecific taxa. This paper typifies two known hybrids between Eurasian varieties of *J. communis*, and discusses several confusing names proposed in this group, related with these nothovarieties. *Juniperus communis* nothovar. *intermedia* is a hybrid between *J. communis* var. *communis* and *J. communis* var. *saxatilis*, widely distributed in Europe, but sometimes ignored or confused with other taxa; several names applied to infraspecific taxa of this group actually seem to refer to this hybrid. It was described in 1851, but there is no known type; a neotype is proposed in this paper. A hybrid between *J. communis* var. *hemisphaerica* and *J. communis* var. *saxatilis* was reported in 2020, but not properly described; it is done in this paper. *Published online www.phytologia.org Phytologia 106(2): 13-32 (June 20, 2024). ISSN 030319430.*

**KEY WORDS:** Juniper taxonomy, Juniper hybrids, Typification

---

The *Juniperus communis* L. complex is widely distributed throughout the northern hemisphere, with several infraspecific entities, morphologically different but genetically quite similar. In his description of the species Linné (1753) recognized the occurrence of infraspecific entities, describing three groups: a tree juniper, a shrub juniper and a minor mountain juniper. Along the 19th century three entities were differentiated in Europe. The first one included ascending to arborescent junipers with straight patent leaves. The second group included procumbent mountain junipers with incurved leaves. A third group was added in 1822, of procumbent mountain junipers with straight leaves, described from Sicilian specimens. According to the different authors, these groups were considered species, varieties or subspecies, with a plethora of names, among which *sibirica*, *saxatilis*, *nana*, *montana* or *alpina* dominate for the first group, *communis*, *suecica* or *vulgaris* for the second, and *hemisphaerica* for the latter.

The profuse taxonomy of *J. communis* is due to its variability and the fact that the characters used in its differentiation are not decisive individually, although they may be consistent when considered together. The groups of junipers have been separated for their leaves of a somewhat different width or length to the “type” juniper, incurved or straight, and with seed cones of greater or lesser size; but in all cases it is possible to find a continuous range of shapes and dimensions between the extremes. In addition, the habit of the plant is a constant in the descriptions, although it is strongly influenced not only by climate and wind exposure, but also by human action. Adams and Schwarzbach (2012) indicate that the separation between *J. communis* var. *communis* and *J. communis* var. *saxatilis* Pallas in Europe and Central Asia is largely based on the arboreal versus shrubby habit, although many populations include individuals ranging from trees to decumbent shrubs. Arborescent junipers are common in some regions, but rare in others, such as the Mediterranean, where a very slow growth is combined with a secular anthropic pressure. The variability of *J. communis* is evident within a population, with a large number of morphotypes, but also at the individual level, with branches with leaves of different curvature, width and length (Enríquez-de-Salamanca 2017).

Traditionally the juniper entities were defined by the coincidence of morphological characters, highly variable as seen. It is possible to find specimens coincident with one of the three groups cited, but also a large number of intermediate forms. This has been interpreted as introgressions or hybrids, although sometimes the presence of all three groups has been cited even in the same locality. A second stage in the taxonomy of junipers was based on the use of chemistry, differentiating entities according to their composition (e.g., Adams 1970, 1998; Barbero et al. 1990; Caramiello et al. 1995; Filipowicz et al. 2006; Mustafa et al. 2016). The most recent approaches apply DNA, being increasingly more precise; most of the work was conducted by R.P. Adams and collaborators (e.g., Adams et al. 2011, 2020; Adams and Schwarzbach 2012; Adams and Espeut 2020). One of these studies (Adams et al. 2003) identified two major groups of *J. communis*, one from America and the other from Eurasia. The validity of *Juniperus hemisphaerica* J. Presl & C. Presl, one of the three groups described above, has been discussed; initially rejected based on DNA studies (Adams and Pandey 2003; Adams 2011), it was recovered in subsequent studies (Adams and Schwarzbach 2012).

There is no consensus among botanists in the taxonomic treatment of this group, due to discrepant criteria when considering species, subspecies, or varieties, and even different criteria for what constitutes a variety or a subspecies. Clausen (1941) indicated that the variety was the oldest infraspecific unit, first used by Linnaeus, and subspecies were proposed later to separate the most important variations within a species, often correlated with geographical, ecological or physiological isolation. According to this author using the term variety for those important variations is to assign a new meaning to it. Kapadia (1963) considered that the rank below the species is the variety, and if different varieties show patterns of affinities, then they should be grouped in subspecies. Hamilton and Reichard (1992) pointed out that despite attempts to differentiate subspecies and varieties, they are largely equivalent in practice, and that taxonomists use the former (especially in the United States) or the latter (especially in Europe) in the same sense. Hamilton (1995) pointed out that the choice between subspecies and varieties is more related to the taxonomists' country of origin than to the biology of the plants. The Botanical Code (Turland et al. 2018) indicates that the main rank below the species is the variety, but accepts that subspecies may be defined without the existence of varieties.

Considering the *J. communis* groups as independent species is increasingly uncommon, even more so after genetic studies have showed their similarity. One of the most influential works in Europe that defended the treatment as independent species was Flora d'Italia (Pignatti 1982), which recognized *J. communis*, *J. nana* Willd. and *J. hemisphaerica*. Franco (1962) and Franco and Rocha (1968) proposed a subspecific treatment, which the first author maintained in Flora Europaea (Franco 1964) and in Flora iberica (Franco 1986); the same approach was followed in other European floras, such as that of the British Isles (Thomas et al. 2007), Eastern Andalusia (Pérez-Latorre et al., 2011) or France (Tison and Foucault 2014). In contrast, Adams (1993) considered these groups varieties in Flora of North America, and in all his subsequent profuse work. The varietal treatment was also chosen by Farjon (2001, 2005), Farjon et al. (2014) or Schulz et al. (2005). There are, thus, specific, subspecific and varietal schools that do not agree. There is a morphological differentiation at the extremes of the "*saxatilis*" and "*communis*" groups, but not in the intermediate specimens; genetic differentiation is scarce; and the groups have a different ecology, with creeping junipers growing mainly in mountain areas. There are valid arguments supporting both subspecific and varietal differentiation. This paper does not aim to resolve this taxonomic conflict, but it is not possible to approach the taxonomy of *J. communis* without adopting an *a priori* position on the treatment of the infraspecific rank. We have opted for the varietal treatment, consistent with the scarce genetic differentiation of the infraspecific entities, and which seems to arouse greater consensus at present.

This paper focuses on two hybrids between the described groups. The first, originally named *J. intermedia* Schur., has been widely cited throughout Europe for a century and a half. We vindicated the validity of this hybrid, proposing a typification, which is currently missing. There are several names applied

to parts of the *J. communis* complex that have been misinterpreted, and that should be referred to this nothotaxa. The second is a hybrid recently reported, in 2020, but not properly described.

## MATERIALS AND METHODS

The starting point for this work was the identification, in Spain, of frequent specimens with intermediate characters between *J. communis* var. *communis* and *J. communis* var. *saxatilis* (*J. communis* subsp. *alpina* (Suter) Čelak in Spanish floras, such as Franco, 1986 and Pérez-Latorre et al., 2011), growing in contact areas between both varieties. Traditionally included in *J. communis* var. *hemisphaerica* (J. Presl & C. Presl) Parl., we attributed them to *J. intermedia* Schur. (Enriquez-de-Salamanca 2017), a hybrid between these two varieties. Numerous references to this hybrid were detected from its description to the present day, along with mentions of introgressions or hybridizations between the parental varieties. However, it has been largely ignored in the floras (except Tison and Foucault 2014) and in the main botanical databases, where it is considered a synonym of some of the main varieties.

To analyze the distribution of this nothotaxon, an initial search for herbarium material attributed to *J. intermedia* (as a species, subspecies or variety) was carried out. This search confirmed the presence of intermediate specimens between *J. communis* var. *communis* and *J. communis* var. *saxatilis* throughout Europe. Analyzing historical descriptions of infraspecific taxa of *J. communis*, we detected several names (mainly from the 19th century but some of them later), whose descriptions pointed to this nothovariety. In some cases the currently established synonymies were not consistent with the descriptions. Herbarium materials referred to these taxa were consulted, online or in person, searching wherever possible for types, to determine their attribution. As a result, eight of these names, published between 1841 and 2002, have been proposed as synonyms of *J. communis* nothovar. *intermedia*. In this search for herbarium material, we detected frequent attributions of specimens to infraspecific taxa of *J. communis* that were not consistent with the original descriptions. Especially, throughout Europe disparate specimens of juniper have been included in *J. hemisphaerica* (as a species, subspecies or variety), frequently with little relation to what was originally described. The *J. intermedia* described by Schur in 1851 lacks a type. During the searches for material, a specimen collected by Sanio in 1852 was located, and has been proposed as a neotype. After these synonyms were identified, a global search of academic literature, grey literature, herbarium sheets, and databases was carried out to establish the distribution of the nothotaxon.

During these searches, reference was also found to a hybrid between *J. communis* var. *hemisphaerica* and *J. communis* var. *saxatilis*, reported in 2020 for southern Spain and France. The original publication lacks a description and typification, but the material cited by the authors has been located in the herbarium of Baylor University. We have done an effective typification.

## TAXONOMIC TREATMENT

*Juniperus communis* nothovar. *intermedia* (Schur) Sanio, Deutsche Bot. Monatsschr. 4: 51 (1883) ≡ *Juniperus communis* var. *communis* × *Juniperus communis* var. *saxatilis* Pallas. Basionym: *Juniperus intermedia* Schur, Verh. Mitth. Siebenbürg. Vereins Naturwiss. Hermannstadt 10: 169 (1851); *ind. loc.*: [Romania] Transylvania (Schur, 1851); [Romania, Southern Carpathians] Fogarascher Alpen aus einer Höhe von 3000 (Fuss, 1851); type unknown or not described. **Neotype** (designated here): [Poland, Warmia–Masuria] Lyck [Elk], Schedlisken [Siedliska] Berge auf einer mit Gebüsch bewachsenen Wiese, C.G. Sanio, 6 October 1852, AMD 126030 (Fig. 1)  
 = *J. communis* var. *montana* Aiton *sensu* Spach, Ann. Sci. Nat., Bot. 12: 301 (1841), *nom. illeg.*, syn. nov.  
 = *J. nana* var. *montana* (Aiton) Endl., Syn. Conif. 14 (1847), *nom. illeg.*, syn. nov.  
 = *J. pygmaea* K.Koch, Linnaea 22(3): 302 (1849), syn. nov. = *Juniperus communis* subsp. *pygmaea* (K.Koch) Imkhan., Novosti Sist. Vyssh. Rast. 27: 10 (1990), syn. nov.

- =*J. depressa* Steven, Bull. Soc. Imp. Naturalistes Moscou 30(2): 398 (1857), *nom. invalid.*, *syn. nov.*  
Lectotype (designated by Shevera and Fedoronchuk 2011): Tauria [Crimea], 1813, Steven, H 1505535; syntype LE 01078132 = *J. communis* var. *depressa* (Steven) Boiss. Fl. Orient. 5: 707 (1884), *nom. illeg.*, *syn. nov.*
- =*J. communis* subsp. *intermedia* (Schur) K. Richt., Pl. Eur. 1: 6 (1890) Pallas
- =*J. sibirica* var. *montana* (Aiton) Beck, Blätt. Vereins Landesk. Nieder-Österreich 1890: 78 (1890), *nom. illeg.*, *syn. nov.*
- =*J. communis* var. *castellana* Sennen & Pau, Bull. Acad. Inst. Géogr. Bot. 229: 466 (1908), *syn. nov.*; *ind. loc.*: entre Vitoria et Miranda de Ebro; Lectotype: [Spain, Burgos] Castille, Buggedo, garrigues, Apr 1906, Sennen & Hno. Elias, BC 59409; syntypes: MA 01 2773, MA 02 2773, MA 01 2776, MA 02 2776; paratypes: MA 01 2775, BC 59408
- =*J. communis* subsp. *communis* var. *intermedia* (Schur) Sanio in Bolòs & Vigo, Fl. Països Catalans 201 (1984), *nom. illeg.*
- =*J. communis* nothosubsp. *guadarramica* Rivas Mart., Itinera Geobot. 15(2): 703 (2002) *nom. invalid.*, *syn. nov.*
- =*J. communis* nothosubsp. *intermedia* (Schur) Enríquez de Salamanca, Fl. Montib. 69: 33 (2017), *nom. illeg.*



Figure 1. Neotype of *Juniperus communis* nothovar. *intermedia* (Schur) Sanio. AMD126030 (Photograph: Naturalis Biodiversity Center, licensed under CC0).

**Description:** Intermediate between parents. Shrub decumbent, rarely erect, with ascendent branches. Leaves 10-20 x 1-2 mm, patent to slightly subimbricate, with curved base. Fertile hybrid; seed cones ovoid or globose, 6-10 mm, dark blue, often pruinose. It differs from *J. communis* var. *communis* by the curved base of the leaves, often with a slightly subimbricate distribution. It differs from *J. communis* var. *saxatilis* in its decumbent or ascending shape, never creeping or prostrate, and in its slightly imbricate leaves, with a tendency to be patent.

**Distribution** (Fig. 2): **ALBANIA:** Shkodër, Kukër, Janković (1960, as *J. intermedia*). **ANDORRA:** MA918747, GBIF (2023, as *J. hemisphaerica*), GBIF (2023, as *J.c.* subsp. *communis* var. *intermedia*). **ARMENIA:** B100469800, MA742249, UTC239185, GBIF (2023, as *J. depressa*), MW642518, MW642519, MW0642522 to MW0642531, MDH (2023, as *J. depressa* et *J. hemisphaerica*), P01636676, GBIF (2023, as *J. oblonga*), Boissier (1884, as *J.c.* var. *depressa*), Grossgejm (1928, 1949, as *J. depressa*), Takhtajan (1954, as *J. depressa*), Takhtajan (2003, as *J.c.* subsp. *hemisphaerica*). **AUSTRIA:** Alps [unprecise] Vierhapper and Handel-Mazetti (1905, as *J. intermedia*), Elwes and Henry (1912, as *J.c.* var. *intermedia*), Vidakovic (1991, as *J.c.* var. *intermedia*); **Kärnten**, Hruba (1916, as *J. intermedia*); **Niederösterreich**, LI100297221, GBIF (2023, as *J. intermedia*); **Steiermark**, Hayek (1901, 1904, as *J. intermedia*), Schittengruber (1960, as *J. intermedia*); **Tirol**, Kerner (1889, as *J. intermedia*), MA171891, RJB (2023, as *J. intermedia*), CLF142346, LY670275, GBIF (2023, as *J. intermedia*), ReColNat (2023, as *J. intermedia*). **AZERBAIJAN:** MW0642532 to MW0642541, MDH (2023, as *J. depressa* et *J. hemisphaerica*), Boissier (1884, as *J.c.* var. *depressa*), Grossgejm (1928, 1949, as *J. depressa*), Takhtajan (2003, as *J.c.* subsp. *hemisphaerica*). **BULGARIA:** Yugozapaden, Rechinger (1933, as *J. intermedia*), Komarov and Il'in (1968, as *J. depressa*). **BOSNIA-HERZEGOVINA:** Federation of Bosnia and Herzegovina, Siljak-Yakovlev et al (2010, as *J. intermedia*), Operta et al (2018, as *J. intermedia*); **Republika Srpska**, Fukarek (1969, as *J. intermedia*). **CROATIA:** Lika-Senj, SVNP (2023, as *J. intermedia*); **Primorje-Gorski Kotar**, Vidakovic (1991, as *J.c.* var. *intermedia*), ZAH058197 to ZAH058200, FCD (2023, as *J. intermedia*). **CZECHIA:** Moravskoslezský, NATURALIS (2024, as *J. nana* var. *intermedia*); **Olomoucký**, Oborny (1885, as *J. intermedia*), BRNU593502, JACQ (2023, as *J. intermedia*); **Sudetes** [unprecise] Vidakovic (1991, as *J.c.* var. *intermedia*). **FINLAND:** Lapland, Elwes and Henry (1912, as *J.c.* var. *intermedia*). **FRANCE:** Auvergne-Rhône-Alpes, CLF142345, UniVegE (2023, as *J. intermedia*), Tison and Foucault (2014, as *J.c.* nothosubsp. *intermedia*), CBNA (2023, as *J. × intermedia*), BIODIV'AURA ATLAS (2023, as *J.c.* subsp. *intermedia*), INPN (2023, as *J.c.* nothosubsp. *intermedia*); **Occitanie**, AMD126028, GBIF (2023, as *J. communis* var. *intermedia*), MA233850, P41888, GBIF (2023, as *J.c.* subsp. *hemisphaerica*), Tison and Foucault (2014, as *J.c.* nothosubsp. *intermedia*), INPN (2023, as *J.c.* nothosubsp. *intermedia*); **Provence-Alpes-Côte-d'Azur**, P00044293, GBIF (2023, as *J.c.* subsp. *hemisphaerica*), Barbero (1981, as *J. intermedia*), Lebreton et al (2013, as *J. × intermedia*), Tison and Foucault (2014, as *J.c.* nothosubsp. *intermedia*), CBNA (2023, as *J. × intermedia*), Lamaison (2023, as *J.c.* nothosubsp. *intermedia*), INPN (2023, as *J.c.* nothosubsp. *intermedia*). **GEORGIA:** MO1328390, MO1328511, NY19440, NY804112, GBIF (2023, as *J. hemisphaerica*), MW642459, MW642503 to MW642517, MDH (2023, as *J. depressa* et *J. hemisphaerica*), BR32183573, MA576696, WAG1733039, GBIF (2023, as *J. oblonga*), Boissier (1884, as *J.c.* var. *depressa*), Grossgejm (1928, 1949, as *J. depressa*), Gagnidze (1971, as *J. depressa*), Takhtajan (2003, as *J.c.* subsp. *hemisphaerica*), Gagnidze (2005, as *J. hemisphaerica*). **GERMANY:** Bayern (Oberbayern), Michiels (1996, as *J.c.* var. *intermedia*); **Saarland**, Delattinia (2023, as *J. intermedia*); **Sudetes (Sachsen)** [unprecise] Vidakovic (1991, as *J.c.* var. *intermedia*); **Alps** [unprecise] Elwes and Henry (1912, as *J.c.* var. *intermedia*), Vidakovic (1991, as *J.c.* var. *intermedia*). **GREECE:** Boissier (1884, as *J.c.* var. *depressa*); **C Greece**, LD1291214, GBIF (2023, as *J.c.* subsp. *hemisphaerica*); **Epirus**, LD1286352, LD1298423, GBIF (2023, as *J.c.* subsp. *hemisphaerica*); **Macedonia**, P01621070, RECOLNAT (2023, as *J. depressa*); **Peloponnese**, MA871954, GBIF (2023, as *J.c.* subsp. *hemisphaerica*), LY670708, LY670710, P01636615, RECOLNAT (2023, as *J. depressa*); **Thessaly**, LD1215867, LD1281442, LD1284863, LD1293488, GBIF (2023, as *J.c.* subsp. *hemisphaerica*); **W Greece**, LY670269, LY670271, LY670272, RECOLNAT (2023, as *J. hemisphaerica*).

**IRAN:** Tabriz, Komarov and Il'in (1968, as *J. depressa*), Hamidipour *et al.* (2011, as *J. oblonga*), Kasaian *et al.* (2011, as *J. oblonga*). **IRELAND:** [unprecise] Clapham *et al.* (1987, intermediate forms between *J.c.* subsp. *communis* and *J.c.* subsp. *alpina*), Stace (2010, intermediates between *J.c.* subsp. *communis* and the other two subspecies [*J.c.* subsp. *hemisphaerica* and *J.c.* subsp. *nana*]). **ITALY:** Conti *et al.* (2005, as *J.c.* var. *intermedia*); **Abruzzo**, Pl@ntNet-1008345216, GBIF (2023, as *J. communis*); **Aosta Valley**, Peyronel and Dal Vesco (1971, as *J.c.* var. *intermedia*), Barbero (1981, as *J. intermedia*), Caramiello *et al.* (1995, as *J. intermedia*); **Firuli-Venezia-Giulia**, Pl@ntNet-1007496890, Pl@ntNet-1004197201, GBIF (2023, as *J. communis*); **Lombardia**, Inaturalist-168725251, GBIF (2023, as *J. communis*); **Piedmont**, Caramiello *et al.* (1995, as *J. intermedia*); **Trentino-Alto Adige**, Ribbons (1972, as *J. intermedia*), Meurer (1979, as *J. intermedia*); **Veneto**, Inaturalist-97925794, GBIF (2023, as *J. c.* var. *saxatilis*); **Alps** [unprecise] Elwes and Henry (1912, as *J.c.* var. *intermedia*), Vidakovic (1991, as *J.c.* var. *intermedia*). **KOSOVO:** Gjakova, Janković (1960, as *J. intermedia*), Dauti *et al.* (2003, as *J. intermedia*); **Prizren**, Janković *et al.* (1987, as *J.c.* var. *intermedia*), **MONTENEGRO:** Pljevlja, Žabljak, Petrović *et al.*, (2019, as *J.c.* var. *intermedia*). **NORTH MACEDONIA:** Polog, Janković *et al.* (1987, as *J.c.* var. *intermedia*), Nikolovski (1970, as *J. intermedia*), Vidakovic (1991, as *J.c.* var. *intermedia*), Simovski (2013, 2015, as *J. intermedia*); **Pelagonia**, Em (1978, as *J. intermedia*), Acevski and Simovski (2009, as *J.c.* var. *intermedia*). **NORWAY:** Nord-Norge [unprecise] Rikli (1936, as *J.c.* var. *intermedia*). **POLAND:** Lower Silesia, Boratyński (1985, as *J.c.* subsp. *communis* var. *intermedia*); **Silesia**, RB637945, GBIF (2023, as *J. intermedia*), Browicz and Zieliński (1974, as *J.c.* var. *intermedia*); **Warmia-Masuria**, AMD126030, GBIF (2023, as *J. communis* var. *intermedia*), Sanio (1883, as *J.c.* var. *intermedia*); **Sudetes** [unprecise] Vidakovic (1991, as *J.c.* var. *intermedia*). **ROMANIA:** Centru, MO883899, GRSciColl (2023, as *J. communis* var. *intermedia*), Simonkai (1886, as *J. intermedia*), Römer (1911, as *J. intermedia*), Pop (1939, as *J. intermedia*), Claudiu (2012, as *J.c.* var. *intermedia*); **Nord-Est**, Pop (1939, as *J. intermedia*), Chifu *et al.* (2006, as *J.c.* var. *intermedia*); **Nord Vest**, Gyula (1915, as *J. intermedia*), Pop (1939, as *J. intermedia*), Moldovan (1971, as *J.c.* var. *intermedia*), Claudiu (2012, as *J.c.* var. *intermedia*); **Sud-Muntenia**, Schur (1851, as *J. intermedia*); **Transilvania** [unprecise], Richter (1890, as *J. communis* subsp. *intermedia*); **Carpathians** [unprecise] Vidakovic (1991, as *J.c.* var. *intermedia*). **RUSSIA:** North Caucassian, NSK66161, NSK66174, LY670712, LY670713, LY670715, GBIF (2023, as *J. depressa*), MW638299, MW642463 to MW642465, MW642479 to MW642501, MDH (2023, as *J. depressa et J. hemisphaerica*), BR32183511, BR32183498, BR32183559, NSK66160, GBIF (2023, as *J. oblonga*), Grossgejm (1928, 1949, as *J. depressa*), Takhtajan (2003, as *J.c.* subsp. *hemisphaerica*), Murtazaliev (2009, as *J. hemisphaerica*); **North of Russia** [unprecise], Rikli (1936, as *J.c.* var. *intermedia*); **Southern**, MW642460 to MW642462, MW642470 to MW642472, MW642502, MW1011806, MDH (2023, as *J. depressa et J. hemisphaerica*). **SERBIA:** **Pirot**, Jovanović *et al.* (1992, as *J. intermedia*), Marković *et al.* (2009, as *J.c.* var. *intermedia*); **Nisava**, **Raska**, Lakušić and Lakušić (2011, as *J.c.* subsp. *communis* var. *intermedia*). **SLOVAKIA:** **Banská Bystrica**, Jasičová (1966, as *J.c.* var. *intermedia*); **Prešov**, Hruby (1934, as *J. intermedia*), Jasičová (1966, as *J.c.* var. *intermedia*); **Žilina**, Jasičová (1966, as *J.c.* var. *intermedia*), Kučera (2019, as *J. × intermedia*); **Carpathians** [unprecise] Vidakovic (1991, as *J.c.* var. *intermedia*). **SLOVENIA:** **Zahodna Slovenija**, ZA56104, FCD (2023, as *J. intermedia*); **Vzhodna Slovenija**, Accetto (2001, as *J.c.* var. *intermedia*). **SPAIN:** **Aragón**, BIO10283, GBIF (2023, as *J.c.* var. *intermedia*), MA2738, MA2770, MA326131, GBIF (2023, as *J.c.* subsp. *hemisphaerica*), Gandoger (1896, 1917, as *J. intermedia*), Rivas Goday and Borja (1961, intermediate specimens between *J.c.* subsp. *communis* and *J.c.* subsp. *alpina*), Rivas Martínez *et al.* (2002, as *J. intermedia*); **Basque Country**, LISI001583, GBIF (2023, as *J.c.* subsp. *hemisphaerica*); **Castile-León**, MA2773, MA2775, MA2776, MA2777, RJB (2023, as *J.c.* var. *castellana*), MA2720, MA228430, MA358365, MA567959, MA639977, MA656817, MA7547871, GBIF (2023, as *J.c.* subsp. *hemisphaerica*), Gandoger (1896, 1917, as *J. intermedia*), Enriquez-de-Salamanca (2017, as *J.c.* nothosubsp. *intermedia*); **Castile-La Mancha**, MA2733, MA2734, MA809596, GBIF (2023, as *J.c.* subsp. *hemisphaerica*), Enriquez-de-Salamanca (2017, as *J.c.* nothosubsp. *intermedia*); **Catalonia**, HGI11753, HGI11754, GBIF (2023, as *J.c.* subsp. *communis* var. *intermedia*), Carreras *et al.* (1995, as *J.c.* var. *intermedia*), Soriano (1998, as *J.c.* var. *intermedia*), Ninot and Carrillo (2019, as *J.c.* var. *intermedia*), Bolòs and Vigo (1984, as *J.c.* subsp. *communis* var. *intermedia*), GBIF (2023, as *J.c.* var. *intermedia*); **Madrid**,

MA2718, MA-2763, GBIF (2023, as *J.c.* subsp. *hemisphaerica*), Enríquez-de-Salamanca (2017, as *J.c.* nothosubsp. *intermedia*); **Navarra**, MA809594, GBIF (2023, as *J.c.* subsp. *hemisphaerica*). **SWEDEN: Norland** [unprecise] Rikli (1936, as *J.c.* var. *intermedia*). **SWITZERLAND: AMD126027**, GBIF (2023, as *J. communis* var. *intermedia*), Erb (1897, as *J. intermedia*), Brockmann-Jerosch (1907, as *J.c.* var. *intermedia*), Brunies (1928, as *J.c.* var. *intermedia*), Braun-Blanquet et al (1954, as *J. intermedia*), Theurillat et al (2021, as *J.c.* var. *intermedia*); **Alps** [unprecise] Elwes and Henry (1912, as *J.c.* var. *intermedia*), Vidakovic (1991, as *J.c.* var. *intermedia*). **TÜRKIYE: Aegean, Central Anatolia, Eastern Anatolia and Marmara**, Davis (1965, intermediate between *J.c.* subsp. *hemisphaerica* and subsp. *nana*). **UNITED KINGDOM:** [unprecise] Clapham et al (1987, intermediate forms between *J.c.* subsp. *communis* and *J.c.* subsp. *alpina*), Stace (2010, intermediates between *J.c.* subsp. *communis* and the other two subspecies [*J.c.* subsp. *hemisphaerica* and *J.c.* subsp. *nana*]); **England**, L1187750, GBIF (2023, as *J. communis* subsp. *intermedia*); **Scotland**, E00853899, RBGE (2023, as *J.c.* var. *intermedia*), Bennett (1893a,b, as *J. intermedia*), McNeill (1910, as *J.c.* var. *intermedia*), Matthews (1930, as *J.c.* var. *intermedia*), Hayward and Druce (1930, as *J.c.* var. *intermedia*), Watt (1931, as *J.c.* var. *intermedia*), Heslop (1937, as *J.c.* var. *intermedia*), Muirhead (1961, as *J.c.* var. *intermedia*), Kenneth (1971, as *J.c.* var. *intermedia*), Kenworthy (1976, intermediate forms between *J.c.* subsp. *communis* and subsp. *nana*), Clapham et al (1987, intermediate forms between *J.c.* subsp. *communis* and *J.c.* subsp. *alpina*). **UKRAINE: Crimea**, LY0670711, GBIF (2023, as *J. depressa*), MW0600425 to MW0600456, MW0631697, MDH (2023, as *J. depressa* et *J. hemisphaerica*), BR20384883, NSK0066164, P01621071, GBIF (2023, as *J. hemisphaerica*), Boissier (1884, as *J.c.* var. *depressa*), Komarov and Il'in (1968, as *J. depressa*); **Zakarpattia**, MHA0004442, GBIF (2023, as *J. sibirica*), MHA0000689, GBIF (2023, as *J. communis*); **Carpathians** [unprecise] Vidakovic (1991, as *J.c.* var. *intermedia*).

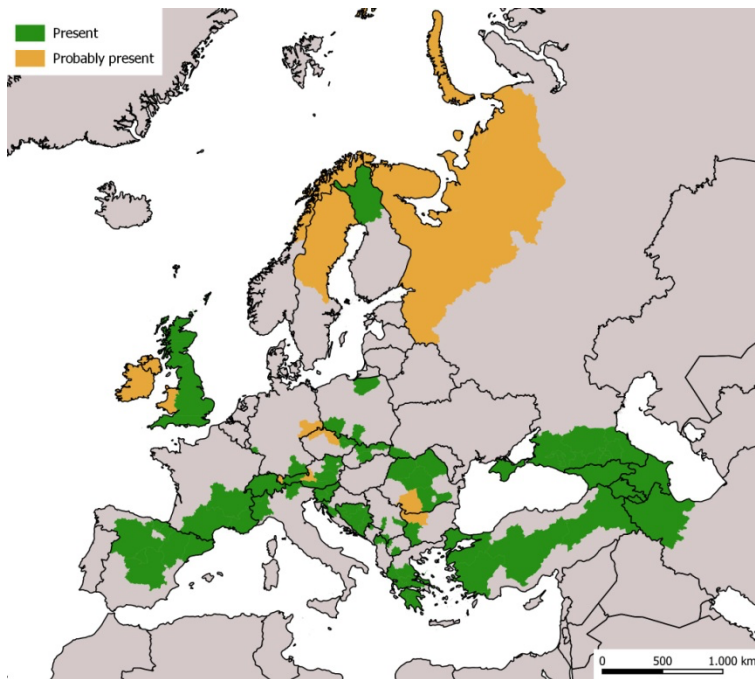


Figure 2. Distribution of *Juniperus communis* nothovar. *intermedia*.

**Discussion:** In the Bulletin of the Transylvanian Society of Natural Sciences of Sibiu in October 1851, Schur (1851) described *J. intermedia* as a form of *J. nana* with long, patent leaves. In the following bulletin (November 1851), Carl Fuss compiled news from the Society (Fuss 1851), indicating that Schur showed wild Transylvanian specimens of *J. communis* and *J. nana*, including an intermediate form from the Fagaras Mountains named *J. intermedia*. In the Flora of Transylvania, Mihály Fuss (1866) includes Schur's species, with no indication of its hybrid origin, but with a Latin description.

Sanio (1883) proposed *J. intermedia* as a variety of *J. communis*, without citing its hybrid origin, while Richter (1890) proposed it as a subspecies, indicating that it was a hybrid. According to the botanical code (Turland et al. 2018), for homonymy and synonymy purposes both the multiplication sign and the prefix *notho-* are ignored, so both combinations are valid as nothovariety and nothosubspecies.

There is no known type for this hybrid, nor has any original material or illustration by Schur been located. There is a specimen collected by Carl Gustav Sanio at Lyck, East Prussia (nowadays Elk, Poland), in 1852 (AMD 126030), just one year after Schur's description, and labeled "*Juniperus communis* L. var. *intermedia* Schur". It was not until 31 years later that Sanio (1883), in his work on the varieties of *J. communis* in the Lyck flora, validly published the name *J. communis* var. *intermedia* (Schur) Sanio. In the absence of original material from Schur, we have proposed as neotype this sheet of Sanio, which is also the material that supports the varietal combination proposed by this author, and which is still the valid name for the nothovariety.

Drobow (1941) described *J. intermedia* Drobow, but it was an illegitimate name, synonym of *J. semiglobosa* Regel, and not the same as *J. intermedia* Schur. Jasičová (1966) considered *J. intermedia* and *J. communis* var. *intermedia* (Schur) Sanio, synonyms of *J. communis* × *J. nana*. Bolòs and Vigo (1984) proposed the combination *J. communis* subsp. *communis* var. *intermedia* (Schur) Sanio, criterion also applied by Boratyński (1985) and Lakušić and Lakušić (2011), but it is an illegitimate name. Adams (2008), in the second edition of his "Junipers of the world" considered *J. intermedia* as a synonym of *J. communis* var. *depressa* Pursh, an erroneous synonymy because *J. communis* var. *depressa* Pursh refers to a juniper from North America, while Schur's description pertained to plants from Romania. However, in the fourth edition of his book (Adams 2014) the Schur's name was considered a synonym of *J. communis* var. *communis*, a criterion also followed by Farjon et al. (2014).

Since Schur's description of *J. intermedia* in 1851, numerous references to this taxon—as a species, subspecies, variety, or hybrid—have been recorded over a century and a half from most of Europe. The taxon began to be cited regularly from the 1880s onwards, with the highest number of citations recorded in recent years. A main source of records is Central Europe. Citations are also abundant in Western and Southern Europe, with France having the highest percentage of recent citations. In this country Lebreton et al. (2000) considered a hybridization-introgression between *J. communis* subsp. *communis* and *J. communis* subsp. *nana* in the Pre-Alps and Massif Central, which they included in this taxon. Tison and Foucault (2014) considered the French citations of *J. communis* subsp. *hemisphaerica* to be confused with *J. communis* nothosubsp. *intermedia*. In Spain, Enríquez-de-Salamanca (2017) analyzed the populations of *J. communis* from the Central Range, where *J. communis* subsp. *communis*, *J. communis* subsp. *alpina* and *J. communis* subsp. *hemisphaerica* were cited; the presence of the latter was ruled out, and these specimens were included in part in *J. communis* subsp. *communis* and in others in *J. communis* subsp. nothosubsp. *intermedia*. Another area with a significant number of records is the Balkan Peninsula. In Eastern Europe and the Caucasus references to *J. intermedia* are fewer because most specimens of this hybrid have been named *J. depressa* Steven or *J. hemisphaerica*. In the British Isles, references to *J. intermedia* mainly come from Scotland, while at the regional level there are several references to intermediate forms between *J. communis* subsp. *communis* and *J. communis* subsp. *nana*, without being given any name. Finally, in Scandinavia there are very few records.

Several names proposed within the *J. communis* complex seem to refer to this nothotaxon:

*Juniperus depressa* Steven.

Pursh (1813) described *J. communis* var. *depressa* Pursh from Canada and the western part of New York. A few decades later, Steven (1857) described *J. depressa* Steven from Crimea, referring to something different. The Steven's description referred to an intermediate form between *J. communis* and *J. pygmaea* (both taxa present in the area), closer to the latter. The syntype (LE01078132) has long leaves, subimbricate, with slightly curved base, so we referred it to *J. communis* nothovar. *intermedia*. Boissier (1884) considered Steven's *J. depressa* to be a variety of *J. communis*, synonym with *J. oblonga* M. Bieb., *J. hemisphaerica*

and *J. pygmaea*, citing it in present-day Greece, Crimea, Georgia, Armenia, Azerbaijan and Iran. Many specimens collected in Crimea and Russia (and more rarely Greece) between 1860 and 2014 (preserved in the herbaria K, LY, MW, NSK and TU) were initially identified as *J. nana* (especially from 1910 to 1923), then as *J. depressa* Steven, and the most recent ones as *J. communis* subsp. *hemisphaerica*. In several sheets *J. depressa*, *J. pygmaea* and *J. hemisphaerica* were considered synonyms, as Boissier (1884) did. Kew sheets K000089226 from Crimea and K000089228 from Iran, labeled as *J. depressa*, were identified by R. P. Adams as *J. communis* var. *montana* (= *J. communis* var. *saxatilis*), an identification that aligns with our opinion. We have included in *J. communis* nothovar. *intermedia* some material from Crimea (LY0670711), Greece (LY0670708, LY0670710) and Russia (LY0670712, LY0670713, LY0670715, NSK0066161, NSK0066174). Most of these plants, including the species' syntype, have leaves that are incurved or subincurved, a character that sets them apart from *J. communis* var. *hemisphaerica* (as proposed by local botanists), and from var. *communis* (as proposed by Farjon et al. 2014). Adams (2008) considered *J. intermedia* as a synonym of *J. communis* var. *depressa* Pursh, a wrong synonymy, but later he changed this opinion (Adams 2014).

*Juniperus communis* / *nana* var. *montana* auct. pl.

The name “montana” was used in the botanical literature of the 18th and 19th centuries referring to varieties of *J. communis*, unevenly. Aiton (1789) applied the name *J. communis* var. *montana* Aiton (= *J. communis* var. *saxatilis*) to small mountain junipers. Neilreich (1859) considered *J. communis* var. *alpina* and *J. communis* var. *montana*, the later a synonym of *J. vulgaris* (= *J. communis* var. *communis*). Sometimes this name refers to specimens that do not belong to either *J. communis* var. *communis* or *J. communis* var. *saxatilis*. According to the original descriptions, we consider some of these names synonyms of *J. communis* nothovar. *intermedia*: *J. communis* var. *montana* Aiton sensu Spach (1841) [shrubby junipers 0.6–1.2 m tall], *J. nana* var. *montana* (Aiton) Endl. [ascending branches crowded of leaves, incurved–patent] and *J. sibirica* var. *montana* (Aiton) Beck.

*Juniperus hemisphaerica* auct. non J. Presl & C. Presl

The species was described by Jan and Carel Presl (Presl 1822) from Mount Etna in Sicily. The differences with *J. communis* were the prostrate shape, the leaves shorter and a little wider, bluish and patent, and the seed cones larger, of equal length or slightly shorter than the leaves. Parlatore (1868) considered this taxon as a variety of *J. communis*, while Nyman (1881) regarded it as a subspecies. Apart from the original region (Sicily), the taxon began to be cited in other areas, especially in Spain, but also in others such as France, Britain, Greece, Crimea or the Caucasus. However, identifications were often not consistent with the original. For example, in Crimea many specimens named *J. hemisphaerica* have little to do with the description of Presl (1882); we have included the revised material part of it in *J. communis* var. *saxatilis* and the rest in *J. communis* nothovar. *intermedia*. Tison and Foucault (2014) considered references to *J. communis* subsp. *hemisphaerica* in France confusion with *J. communis* nothosubsp. *intermedia*, and Enriquez-de-Salamanca (2017) shared the same opinion for Central Spain.

References to this taxon in Britain, specifically in the Lizard peninsula (England) and Pembrokeshire (Wales), are surprising due to its isolation. There seems to be a consensus among British authors and institutions that Lizard populations belong to *J. communis* var. *hemisphaerica*, but not those of Pembrokeshire: Van der Merwe et al. (2000) and Preston et al. (2002) considered that they are *J. communis* subsp. *hemisphaerica*; Evans (2003) indicated that they showed intermediate characters between *J. communis* subsp. *nana* and *J. communis* subsp. *communis* (so they could be *J. communis* nothovar. *intermedia*); Stace (2010) considered that they are probably an extreme of *J. communis* subsp. *communis*; BSBI (2023) does not include this population in its map of the subspecies; BRC (2023) cites it in the text, but refers to the previous map, where it does not appear; and NMW (2023) indicates that recent genetic work indicates that it is *J. communis* subsp. *communis*. These localities are disjunct and isolated, making it

reasonable to assume that they represent an extreme of variation of *J. communis* var. *communis*, or specimens of *J. communis* nothovar. *intermedia*, rather than *J. communis* var. *hemisphaerica*. Genetic studies comparing these populations with those of Sicily and Sierra Nevada are needed.

*Juniperus oblonga* M. Bieb.

Marschall von Bieberstein (1808) described in his Flora taurico-caucasica *J. communis* and *J. oblonga*; the only important difference is that the former was subarborescent, while the latter was shrubby. POWO (2023) considers this name a synonym of *J. communis* var. *saxatilis*, but the original description indicates that the leaves are patent. The herbarium material attributed to *J. oblonga* that we have analyzed is diverse: we have considered some specimens as dense forms of *J. communis* var. *communis*, only one as *J. communis* var. *saxatilis*, and many of them as *J. communis* nothovar. *intermedia* (Armenia P01636676; Georgia BR32183573, MA576696, WAG1733039; Russia BR32183511, BR32183498, BR32183559, NSK66160).

*Juniperus oblonga-pendula* Loudon

Loudon (1838) includes in his description of this taxon a lamina, displaying long leaves, slightly incurved at the base, characters that suggest its possible inclusion in *J. communis* nothovar. *intermedia*. The original description is based on cultivated specimens, introducing a challenge for an accurate attribution. Koch (1863) points out that *J. oblonga-pendula* is probably the male plant of *J. oblonga*.

*Juniperus communis* var. *reflexa* f. *pendula* Carrière

Carrière (1855), in his *Traité Général des Conifères*, introduced a perplexing hierarchy of infraspecific taxa. He proposed a *pendula* form characterized by leaves measuring 15 mm in length, curved towards the branch and with two glaucous lines separated in the middle by a green line. The curved leaves lead to *J. communis* nothovar. *intermedia*, but the green vein is a character of *J. × souliei* Sennen (= *J. communis* var. *communis* × *J. oxycedrus* var. *oxycedrus*).

*Juniperus pygmaea* K. Koch

Koch (1849) described *J. pygmaea* K. Koch from the Hemschin Mountains in Pertakrek (Hemşin, Rize province, Turkey), considering it as a species closely related to *J. nana* (= *J. communis* var. *saxatilis*), but prostrate or pyramidal, and with slightly curved leaves. This description is consistent with *J. communis* nothovar. *intermedia*. There is no known type, and according to Adams et al. (2014) the Koch collection was lost in a fire. Reviewing two herbarium specimens attributed to *J. communis* subsp. *pygmaea*, both collected in 1914 (Turkey NS0007551; unknown location L3774861), we observed the presence of straight leaves with a somewhat curved base, prompting their inclusion in *J. communis* nothovar. *intermedia*. The name *pygmaea* has been frequently used in Eastern Europe. Boissier (1884) considered it a synonym of *J. depressa* Steven, *J. oblonga* M. Bieb. and *J. hemisphaerica* Presl. Adams et al. (2014) examined junipers from Bulgaria and proposed *J. communis* f. *pygmaea* (K. Koch) R. P. Adams & A.N. Tashev. Their study concluded that it represents a shrubby form of *J. communis* var. *communis*, rather than *J. communis* var. *saxatilis*. They also noted specimens of *J. pygmaea* they considered to be of hybrid origin but did not specify the parentage. In a subsequent study in Azerbaijan (Adams et al. 2015), the researchers found discrepancies between what was called *pygmaea* there and their analysis in Bulgaria, so they opted to include them in *J. communis* s.l. While POWO (2023) considers *J. pygmaea* and the form proposed by Adams and Tashev, as synonyms of *J. communis* var. *saxatilis*, we posit that they are more appropriately synonyms of *J. communis* nothovar. *intermedia*.

*Juniperus communis* var. *castellana* Sennen & Pau

Sennen (1908) introduced the name *J. communis* var. *castellana* for creeping shrubs in northern Spain, characterized by shorter leaves compared to normal forms. IPNI (2023) does not include this name, but Flora iberica (2023) database considers it a synonym of *J. communis* subsp. *hemisphaerica*, aligning with the criteria of Joao Amaral Franco, who in 1961 determined some types accordingly. However, upon our examination of the types (BC59408, BC59409, MA 01 2773, MA 02 2773, MA 01 2776, MA 02 2776), we propose their inclusion in *J. communis* nothovar. *intermedia*.

*Juniperus communis* nothosubsp. *guadarramica* Rivas Mart.

Rivas-Martínez et al. (2002) proposed the name *J. communis* nothosubsp. *guadarramica* Rivas Mart. for a hybrid identified in Central Spain between *J. communis* subsp. *nana* and *J. communis* subsp. *hemisphaerica*. However, the presence of *J. communis* var. *hemisphaerica* in Central Spain has been both unproven and refuted (Enríquez-de-Salamanca 2017). Instead, the likely parentage involves *J. communis* var. *communis* and *J. communis* var. *saxatilis*. Therefore, *J. communis* nothosubsp. *guadarramica* should be considered a synonym of *J. communis* nothovar. *intermedia*.

*Juniperus communis* var. *hemisphaerica* (J. Presl & C. Presl) Parl. × *J. communis* var. *saxatilis* Pallas.

**Holotype** (designated here): Spain, Sierra Nevada, s. of Granada, N 37°06.170' W 3°24.515', 2100 m, *Robert P. Adams* 7194, 20 Oct. 1993, BAYLU043718 (Fig. 3, left); syntype (designated here) BAYLU043721 (Fig. 3, right).

**Name:** The International Code of Nomenclature (Turland et al. 2018, article H.10.B.1), indicates that “when contemplating the publication of names for hybrids between named infraspecific taxa, authors should carefully consider whether these names are really needed, bearing in mind that formulae, though more cumbersome, are more informative”. There is no real need to assign a name to this hybrid, so only the hybrid formula has been proposed.

**Description:** This nothotaxon is difficult to diagnose by morphological characters alone. It has subincurved leaves, intermediate between the incurved and subimbricate leaves of *J. communis* var. *saxatilis* and the more or less patent leaves of *J. communis* var. *hemisphaerica*, although both parental taxa show wide variability. The only certainty for their differentiation is based on the genetic analysis conducted by Adams and Espeut (2020) and Adams et al. (2020). According to these authors, the plants from Sierra de Baza (*R. P. Adams* 15695, 15697, 15699, 15701) are heterozygous with nucleotides from both *J. communis* var. *hemisphaerica* and *J. communis* var. *saxatilis*, and the plants from Sierra Nevada (*Robert P. Adams* 7194, BAYLU043718; *Robert P. Adams* 7195, BAYLU043721), initially identified a *J. communis* var. *hemisphaerica*, have an A at site 1149 suggesting they are backcrossed from *J. communis* var. *saxatilis*, and they also have a T at cp petN-psbM site 305, common in *J. communis* var. *saxatilis* from the Pyrenees.

**Distribution** (Fig. 4): **FRANCE. Occitanie**, Pyrénées-Orientales, *Robert P. Adams* 15401 [no known registered herbaria], Adams and Espeut (2020), Adams et al. (2020). **SPAIN. Andalusia**, Granada, Adams and Espeut (2020), Adams et al. (2020): Sierra de Baza, *R. P. Adams* 15695, 15697, 15699, 15701 [no known registered herbaria]; Sierra Nevada, *Robert P. Adams* 7194 (BAYLU043718), *Robert P. Adams* 7195 (BAYLU043721), *S. Rojas Clemente*, MA153763 (genetic confirmation required), *J.M. Losa*, MA589195 (genetic confirmation required).

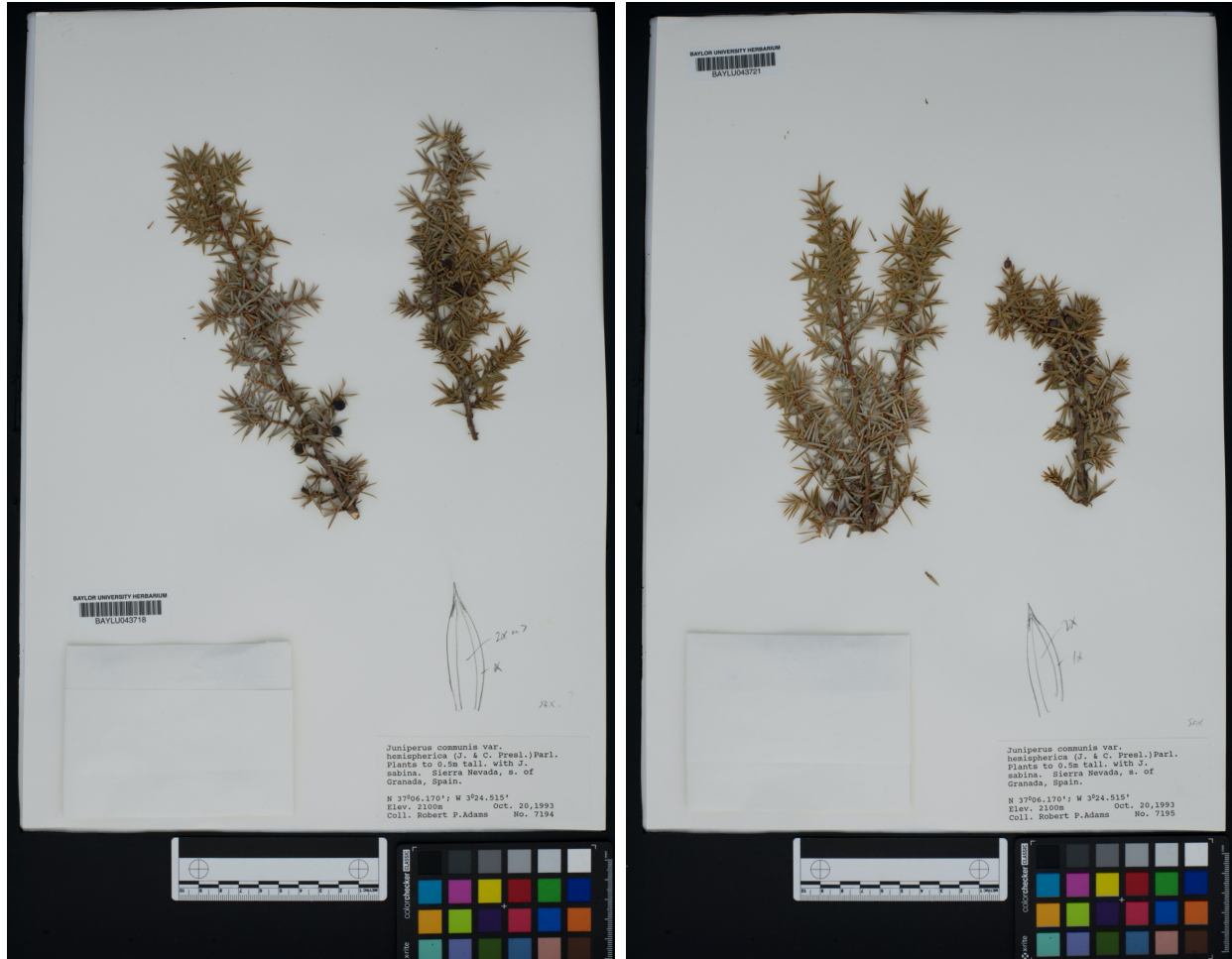


Figure 3. Types of *Juniperus communis* var. *hemisphaerica* × *J. communis* var. *saxatilis*. Left: Holotype, BAYLU043718. Right: Syntype, BAYLU043721 (Photographs: Baylor University Herbarium, licensed under CC0)

**Discussion:** Adams and Pandey (2003) examined RAPDs from *J. communis* var. *hemisphaerica* from its type locality (Mt. Etna, Sicily) and found it to be very similar to typical *J. communis* var. *communis* from Sweden, leading Adams (2011) to consider *J. communis* var. *hemisphaerica* as a synonym of *J. communis* var. *communis*. Similarly, Vargas (2003) found identical *trnL-trnF* sequences in specimens of these infraspecific taxa. However, subsequent research (Adams and Schwarzbach 2012) suggested that DNA data supported the recognition of *J. communis* var. *hemisphaerica* in plants from Mt. Etna in Italy and Sierra Nevada in Spain. Although the shapes of these plants from Sierra Nevada were dissimilar to those from Sicily, their ITS DNA was identical (Adams and Espeut 2020). Adams and Espeut (2020) identified hybrids between *J. communis* var. *hemisphaerica* and *J. communis* var. *saxatilis* in Southern Spain and the French Pyrenees but did not provide proper description and typification. Adams et al. (2020) located more of these hybrids in Southern Spain.

In the French Pyrenees, Adams and Espeut (2020) identified one specimen (*R.P. Adams* 15401) as a hybrid between *J. communis* var. *hemisphaerica* and *J. communis* var. *saxatilis*, displaying genetic markers indicative of both parents, specifically 3 SNPs from the former and the indel and 2 SNPs from the later. However, in this area only one parent, *J. communis* var. *saxatilis*, has been confirmed to be present. These authors suggested either the possibility of *J. communis* var. *hemisphaerica* growing in the region, a

proposition that was refuted by Lebreton et al. (2000) and Tison and Foucault (2014), or alternatively the hypothesis of pollen transfer over long distances. Further genetic studies are required to confirm the presence of this hybrid or discover the second parent. Consequently, this specimen has not been considered as a type for the hybrid.

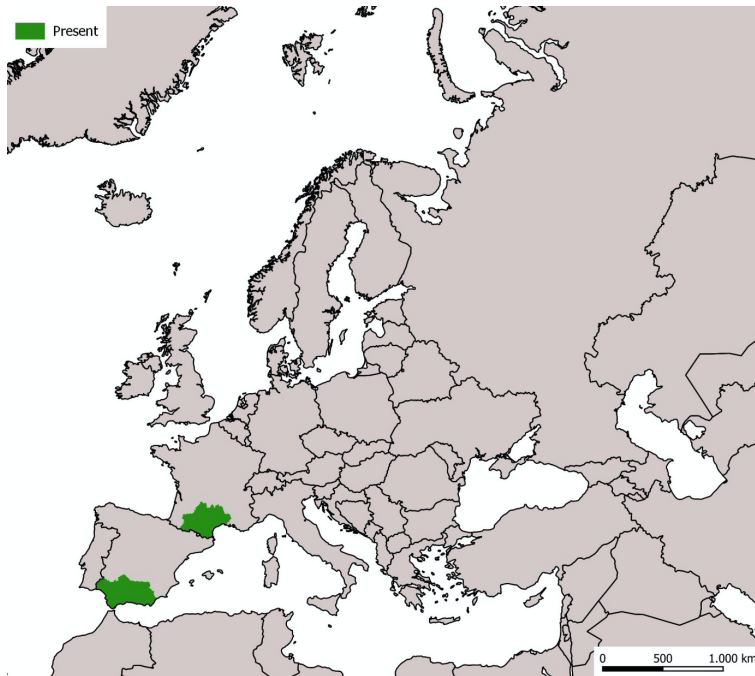


Figure 4. Distribution of *Juniperus communis* var. *hemisphaerica* × *J. communis* var. *saxatilis*

In Granada (Spain) both parents are present, although their ecology is different, with *J. communis* var. *saxatilis* growing in siliceous areas, and *J. communis* var. *hemisphaerica* mainly in limestone (Pérez-Latorre and Cabezudo, 2011). There are numerous herbarium sheets from both taxa in the area, mainly in the herbaria of Cordoba University (COA), Granada University (GDA) and the Royal Botanic Garden of Madrid (MA). Some of these sheets were initially identified as *J. communis* var. *saxatilis*, and subsequently attributed to *J. communis* var. *hemisphaerica*. However, in two cases (MA153763, MA589195) the specimens show intermediate characters between these two taxa, apparently belonging to the hybrid described here, although genetic analysis would be necessary to confirm this. The only specimens with certainty of their hybrid character, because they have been subjected to genetic analysis, and deposited in a registered herbarium, are those collected by Adams in Sierra Nevada (BAYLU043718, BAYLU043721), which have therefore been selected for the typification of the hybrid.

Although *J. communis* nothosubsp. *guadarramica* Rivas Mart. was described as a hybrid between *J. communis* subsp. *nana* and *J. communis* subsp. *hemisphaerica*, their parents are actually *J. communis* var. *communis* and *J. communis* var. *saxatilis*, so it is an illegitimate name, synonym to *J. communis* nothovar. *intermedia*.

#### ACKNOWLEDGEMENTS

I would like to thank Dr. Nemanja Rajčević, from the Faculty of Biology of the University of Belgrade and Dr. Carlos Salazar Mendías, from the Department of Animal Biology, Plant Biology and Ecology of the University of Jaen, for their review of the manuscript and for their enriching comments.

## LITERATURE CITED

- Accetto, M. 2001. New recognitions about the flora of Kocevsko area and Bela krajina (S, SE Slovenia). *Gozd. Vest.* 59(5-6): 248-259.
- Acevski J. and B. Simovski. 2009. Сукцесивни процеси во старите моликови шуми на локалитетот "Бегова Чешма" во Национален Парк "Пелистер". *J. For. Wood Ind.* 42: 140-146.
- Adams, R. P. 1970. Seasonal variation of terpenoid constituents in natural populations of *Juniperus pinchotii* Sudw. *Phytochemistry* 9(2): 397-402.
- Adams, R. P. 1993. *Juniperus* Linnaeus. in *Flora of North America North of Mexico 2* (pp. 412-420). *Flora of North America* editorial committee, ed., Oxford University Press, New York and Oxford.
- Adams, R. P. 1998. The leaf essential oils and chemotaxonomy of *Juniperus* sect. *Juniperus*. *Biochem. Syst. Ecol.* 26(6):637-645.
- Adams, R. P. and R. N. Pandey. 2003. Analysis of *Juniperus communis* and its varieties based on DNA fingerprinting. *Biochem. Syst. Ecol.* 31: 1271-1278.
- Adams, R. P., R. N. Pandey, J. W. Leverenz, N. Dignard, K. Hoegh and T. Thorfinnsson. 2003. Pan-Arctic variation in *Juniperus communis*: historical biogeography based on DNA fingerprinting. *Biochem. Syst. Ecol.* 31: 181-192.
- Adams, R. P. 2008. *Junipers of the world: the genus Juniperus*, 2nd ed. Trafford Publishing, Vancouver.
- Adams, R. P., J. Murata, H. Takahashi and A. E. Schwarzbach. 2011. Taxonomy and evolution of *Juniperus communis*: insight from DNA sequencing and SNPs. *Phytologia* 93(2): 185-196.
- Adams, R. P. and A. E. Schwarzbach. 2012. Taxonomy of *Juniperus* section *Juniperus*: Sequence analysis of nrDNA and five cpDNA regions. *Phytologia* 94: 280-297.
- Adams, R. P., A. N. Tashev and A. E. Schwarzbach. 2014. Variation in *Juniperus communis* trees and shrubs from Bulgaria: analyses of nrDNA and cpDNA regions plus leaf essential oil. *Phytologia* 96(2): 124-129.
- Adams, R. P. 2014. *Junipers of the world: the genus Juniperus*. 4th ed. Trafford Publishing, Bloomington.
- Adams, R. P., V. Farzaliyev, A. N. Tashev and A. E. Schwarzbach. 2015. *Juniperus communis* in Azerbaijan: analyses of nrDNA and cpDNA regions. *Phytologia* 97(1): 6-11.
- Adams, R. P. and M. Espeut. 2020. Hybridization and introgression between *Juniperus communis* var. *saxatilis* and var. *hemisphaerica* in the Pyrenees Mountains, France. *Phytologia* 102(1): 9-13.
- Adams, R. P., S. T. Johnson, C. Salazar-Mendias and J. Altarejos. 2020. Hybridization and introgression between *Juniperus communis* var. *saxatilis* and var. *hemisphaerica* in southeastern Spain. *Phytologia* 102(1): 83-87.
- Aiton, W. 1789. *Hortus Kewensis; or, a catalogue of the plants cultivated in the Royal Botanic Garden at Kew, 3, Diadelphia-Cryptogamia*. George Nicol, London.
- Barbero, M. 1981. Les penetrations méditerranéennes dans la haute Montagne alpine. *Anales Jard. Bot. Madrid* 37(2): 301-314.
- Barbero, M., C. Bayet, A. Hammoud, C. Laracine-Pittet and P. Lebreton. 1990. Diversité biologique du Génévrier commun, espèce collective flavoniquement polymorphe. *Ecol. Mediterr.* 16: 13-39.
- Bennett, A. 1893a. *Juniperus intermedia* Schur. *J. Bot.* 31: 250.
- Bennett, A. 1893b. *Juniperus intermedia* Schur. *Ann. Scott. Nat. Hist.* 8: 250-251.
- BIODIV'AURA ATLAS. 2023. Observatoire Régional de la Biodiversité. Retrieved from <https://atlas.biodiversite-auvergne-rhone-alpes.fr>
- Boissier, E. 1884. *Flora Orientalis sive, Enumeratio plantarum in Oriente a Graecia et Aegypto ad Indiae fines hucusque observatarum*, 5(2), Monocotyledoneæ, Pars posterior Gymnospermae, Acotyledoneæ vasculares. Apud. H. Georg, Geneve and Basel.
- Bolòs, O. and J. Vigo. 1984. *Flora dels Paisos Catalans*, 1, Licopodiàcies-Capparàcies. Barcino, Barcelona.
- Boratyński, A. 1985. Rzadkie i godne ochrony drzewa i krzewy polskiej części Sudetów, Pogorza i Przedgorza Sudeckiego, 1, *Juniperus communis* L. s.l. *Arbor. Kornickie* 30:111-126.
- Braun-Blanquet, J., H. Pallmann and R. Bach. 1954. Pflanzensoziologische und bodenkundliche Untersuchungen im schweizerischen Nationalpark und seinen Nachbargebieten. II. Vegetation und

- Böden der Wald- und Zwergstrauchgesellschaften (*Vaccinio-Piceetalia*). *Ergeb. Wiss. Unters. Schweiz Natl Park* 4.
- BRC. 2023. Biological Records Centre. Online Atlas of the British and Irish flora. Retrieved from <https://www.brc.ac.uk/plantatlas/>
- Brockmann-Jerosch, H. 1907. Die Flora des Puschlav (Bezirk Bernina, Kanton Graubünden). W. Engelmann, Leipzig.
- Browicz, K. and J. Zieliński. 1974. Nowe formy jałowca halnego z Pilska. *Arbor. Kornickie* 30: 111-126.
- Brunies, S. 1928. Unser Nationalpark und die ausserschweizerischen alpinen Reservationen. Beer & Cie, Zurich.
- BSBI. 2023. Botanical Society of Britain & Ireland. *Juniperus communis* L. Retrieved from <http://sppaccounts.bsbi.org/content/juniperus-communis-1.html>
- Caramiello, R., A. Bocco, G. Buffa and M. Maffei. 1995. Chemotaxonomy of *Juniperus communis*, *J. sibirica* and *J. intermedia*. *J. Essent. Oil. Res.* 7: 133-145.
- Carreras, J., E. Carrillo, X. Font, J. M. Ninot, I. Soriano and J. Vigo. 1995. La vegetación de las sierras prepirenaicas situadas entre los ríos Segre y Llobregat. 1. Comunidades forestales (bosques, mantos marginales y orlas herbáceas). *Ecol. Mediterr.* 21(3-4): 21-73.
- Carrière, E.A. 1855. *Traité général des conifères ou description de toutes les espèces et variétés aujourd'hui connues, avec leur synonymie, l'indication des procédés de culture et de multiplication qu'il convient de leur appliquer.* Author, Paris.
- CBNA. 2023. Conservatoire Botanique National Alpin. Atlas communal de la flore des Alpes. Retrieved from <https://www.cbn-alpin.fr/Atlas/AtlasFlore/CartesEspeces/MenuAtlas.htm>
- Chifu, T., C. Mânzu and O. Zamfirescu. 2006. Flora și vegetația Moldovei (România). Editura Universității Alexandru Ioan Cruza, Iași.
- Clapham, A. R., T. G. Tutin and D. M. Moore. 1987. *Flora of the British Isles*. 3rd edn. Cambridge University Press, Cambridge.
- Claudiu, T. G. and B. Petru. 2012. Contributions to the knowledge of *Juniperus* scrubs from Apuseni Mountains, Romania. *Analele Univ. Oradea, Prot. Mediu* 31: 507-515.
- Clausen, R. T. 1941. On the use of the terms “subspecies” and “variety”. *Rhodora* 43: 157-167.
- Conti, F., G. Abbate, A. Alessandrini, C. Blasi, S. Bonacquisti and E. Scassellati. 2005. An annotated checklist of the Italian vascular flora. Ministero dell’Ambiente e della Tutela del Territorio-Università degli Studi di Roma La Sapienza, Roma.
- Dauti, E., E. Hoxha, R. Pllana, V. Pruthi, H. Shabanaj, S. Restelica, V. Dabinovci, E. Krasniqi, Y. Sherifi, N. Shkodra et al. 2003. Studim Mbi arsyeshmërinë e shpalljes së territorit të bjeshkëve të nemuna Park nacional. Ministria e Mjedisit Dhe Planifikimit Hapësinor, Pristina.
- Davis, P. H. 1965. *Flora of Turkey and East Aegean Islands* 1. Edinburgh University Press, Edinburgh.
- Delattinia. 2023. Faunistisch-Floristischen Informationsportal des Saarlandes und der Saar-Mosel-Region. Naturforschende Gesellschaft des Saarlandes. Retrieved from <https://www.kartierung.delattinia.de/>
- Drobow, V. P. 1941. *Juniperus intermedia*. *Bot. Mater. Gerb. Bot. Inst. Uzbekistansk Fil. Akad Nauk SSSR.* 7: 6.
- Elwes, H. J. and A. Henry. 1912. *The trees of Great Britain and Ireland*, 6. Priv. print, Edinburgh.
- Em, H. 1978. O nekim osobenostima borovih suma Makedonije I. Reliktne crnoborove zajednice. *Mitt. Ostalpin-Dinar Ges.* 14: 129-145.
- Enriquez-de-Salamanca, Á. 2017. Ecología, taxonomía y corología de *Juniperus communis* L. en el centro de España. *Fl. Montib.* 69: 27-40.
- Erb, J. 1897. Ueber den Werth der Blattanatomie zur Charakterisierung von *Juniperus communis* L., *J. nana* Willd und *J. intermedia* Schur. *Mitt. Bot. Mus. Univ. Zürich* 3: 83-95.
- Evans, S. 2003. The prostrate junipers of Pembrokeshire. *Welsh Bull.* 71: 13-17.
- Farjon, A. 2001. *World checklist and bibliography of conifers*. 2nd edn. Royal Botanic Gardens Kew, London.
- Farjon, A. 2005. *Monograph of Cupressaceae and Sciadopitys*. Royal Botanic Gardens Kew, London.

- Farjon, A., M. Gardner and P. Thomas. 2014. Conifer Database. in Catalogue of life checklist. O. Bánki, Y. Roskov, M. Döring, G. Ower, D. R. Hernández, C. A. Plata, T. Stjernegaard, A. Örn, L. Vandepitte, D. Hobern et al., eds. <https://doi.org/10.48580/dfp3-393>
- FCD. 2023. Flora Croatica Database. University of Zagreb - Agency for the Environment and Nature Protection (MINGOR). Retrieved from <https://hirc.botanic.hr/fcd/>
- Filipowicz, N., A. Piotrowski, J. R. Ochocka and M. Asztemborska. 2006. The phytochemical and genetic survey of common and dwarf juniper (*Juniperus communis* and *Juniperus nana*) identifies chemical races and close taxonomic identity of the species. *Planta Med.* 72: 850-853.
- Flora iberica. 2023. Flora iberica database. Real Jardín Botánico, Madrid. Retrieved from <http://www.floraiberica.es/>
- Franco, J. A. 1962. Taxonomy of the common juniper. *Bol. Soc. Brot.* 36: 101-120.
- Franco, J. A. 1964. *Juniperus* L. in *Flora Europaea* 1 (pp. 38-39). T. G. Tutin, V. H. Heywood, N. A. Burgues, D. H. Valentine, S. M. Walters and D. A. Webb, eds., Cambridge University Press, Cambridge.
- Franco, J. A. and M. L. Rocha. 1968. Distribuição de zimbros e pomóideas na Península Ibérica. *Collect Bot.* 7: 449-481.
- Franco, J. A. 1986. *Juniperus* L. in *Flora iberica* 1 (pp. 181-185). S. Castroviejo, M. Laínz, G. López, P. Montserrat, F. Muñoz, J. Paiva and L. Villar, eds. Real Jardín Botánico-CSIC, Madrid.
- Fukarek, P. 1969. Šibljačke Zajednice Pretplaninskog Pojasa Nekih Bosansko-Hercegovaukih Planina. *Acta Bot. Croat.* 28: 75-79.
- Fuss, C. 1851. Vereinsnachrichten. *Verh. Mitth. Siebenbürg Vereins Naturwiss. Hermannstadt.* 11: 172-175.
- Fuss, M. 1866. *Flora transsilvaniae excursoria*. Haeredum Gerogii de Closius, Sibiu.
- Gagnidze, R. 1971. *Sakartvelos Flora* 1. 2nd edn. Metsniereba, Tbilisi.
- Gagnidze, R. 2005. *Vascular plants of Georgia. A nomenclatural checklist*. Georgian Academy of Sciences, Tbilisi.
- Gandoger, M. 1896. Lettre de M. Michel Gandoger à M. Malinvaud. *Bull. Soc. Bot. Fr.* 43: 31-35.
- Gandoger, M. 1917. *Catalogue des plantes récoltées en Espagne et en Portugal pendant mes voyages de 1894 à 1912*. Hermann, Paris.
- GBIF. 2023. Global Biodiversity Information Facility. Retrieved from <https://www.gbif.org/>
- Grossheim, A. A. 1928. *Flora Kavkaza* 1. Narodnyi Komissariat Zemledeliya SSR Armenii, Tbilisi.
- Grossheim, A. A. 1949. *Opredelitel' rastenij Kavkaza*. Sovetskaja Nauka, Moscow.
- GRSciColl. 2023. Global Registry of Scientific Collections. Retrieved from <https://scientific-collections.gbif.org/>
- Gyula, P. 1915. Néhány adat hazánk flórájának ismeretéhez. Einige Beiträge zur Kenntnis der Flora von Ungarn. *Magyar Bot. Lapok.* 14(5): 251-258.
- Hamidipour, A., T. Radjabian, D. A. Charlet and M. Zarrei. 2011. Leaf anatomical investigation of Cupressaceae and Taxaceae in Iran. *Wulfenia* 18: 95-111.
- Hamilton, C. W. and S. H. Reichard. 1992. Current practice in the use of subspecies, variety, and forma in the classification of wild plants. *Taxon* 41: 485-498.
- Hamilton, C. W. 1995. Implications of the equivalence of subspecies and variety, and of the irrelevance of forma. *Acta Hort.* 413: 57-64.
- Hayek, A. 1901. Beiträge zur Flora von Steiermark. *Österr. Bot. Z.* 51: 241-253.
- Hayek, A. 1904. Die Vegetationsverhältnisse von Schladming in Obersteiermark. Vorarbeiten zu einer pflanzengeographischen Karte Österreichs 1. Alfred Hölder, Vienna.
- Hayward, W. R. and G. C. Druce. 1930. *Hayward's Botanist's pocket-book; containing the chief characteristics of British plants; with botanical name, common name, soil or situation, colour, growth, and time of flowering of every plant, arranged under its own order*. G. Bell, London.
- Heslop, J. W. 1937. A preliminary flora of the Outer Hebrides. *Proc. Univ. Durham Philos. Soc.* 10: 228-273.

- Hruby, J. 1916. Die Grenzgebiete Kärntens und des nw. Küstenlandes gegen Italien und ihre Pflanzendecke. Österr. Bot. Z. 66(5-6): 186-196.
- Hruby, J. 1934. Beitrag zur Pilzflora der West-Karpathen. Folia Cryptogam. 1(2): 1073-1106.
- INPN. 2023. Inventaire National du Patrimoine Naturel. Muséum National d'Histoire Naturelle - Office Français de la Biodiversité. Retrieved from <https://inpn.mnhn.fr/>
- IPNI. 2023. International Plant Name Index. Retrieved from <https://www.ipni.org/>
- JACQ. 2023. Virtual Herbaria Website. <https://www.jacq.org>
- Janković, M. M. 1960. Rasmatranja o uzajamnim odnosima molike (*Pinus peuce*) i munike (*Pinus heldreichii*), kao i o njihovim ekološkim osobinama, posebno u odnosu na geološku podlogu. Glasn. Bot. Zavoda i Bašte Univ. Beograd 1(2): 141-180.
- Janković, M. M., R. Popović, J. Dimitrijević and B. Stevanović. 1987. Prilog poznavanju ekofiziologije endemoreliktnih Balkanskih Borova *Pinus heldreichii* i *Pinus peuce*. Glasn. Bot. Zavoda i Bašte Univ. Beograd 21: 5-16.
- Jasičová, M. 1966. Coniferophytina. in Flora Slovenska 2 (pp. 243-318). J. Futák, M. Jasičová and E. Schidlay, eds., Vydavateľstvo Slovenskej Akadémie Vied, Bratislava.
- Jovanović, S., V. Stevanović and R. Jovanovic-Dunjić. 1992. Contribution to the knowledge on the serpentine vegetation of Serbia. Bull. Nat. Hist. Mus. Belgrade, B 47: 43-51.
- Kapadia, Z. J. 1963. Varietas and subspecies a suggestion towards greater uniformity. Taxon 12: 257-259.
- Kasaian, J., J. Behravan, M. Hassany, S. A. Emami, F. Shahriari and M. H. Khayyat. 2011. Molecular characterization and RAPD analysis of *Juniperus* species from Iran. Genet. Mol. Res. 10 (2): 1069-1074.
- Kenneth, A. G. 1971. The flora of Danna: a supplement. Trans. Bot. Soc. Edinburgh 41(2): 155-164.
- Kenworthy, J. B. 1976. John Anthony's flora of Sutherland. Botanical Society of Edinburgh, Edinburgh.
- Kerner, A. 1889. Schedae ad floram exsiccata Austro-Hungaricam V. Typographia Caesarea Regia Aulica et Imperiali, Vienna.
- Koch, K. 1849. Beiträge zu einer Flora des Orients. Linnaea 22(3): 177-752.
- Koch, K. 1863. Charles van Geerts' catalogue raisonné des Conifères de pleine terre. Wochenschr. Vereines Beförd. Gartenbaues Königl. Preuss. Staaten. 6(15):119-120.
- Komarov, V. L. and M. M. Il'in. 1968. Flora of the USSR, 1: Archegoniatae and Embryophyta. Israel Program for Scientific Translations, Jerusalem.
- Kučera, P. 2019. *Pinus cembra* communities in the Tatras – comments to the study of Zięba et al. Tuexenia 39: 161-180.
- Lakušić, B. and D. Lakušić. 2011. Anatomy of four taxa of the genus *Juniperus* sect. *Juniperus* (Cupressaceae) from the Balkan peninsula. Bot. Serb. 35: 145-156.
- Lamaison, J. L. 2023. Flore du Pays-Basque. Retrieved from <http://floredepaysbasque.com>
- Lebreton, P., L. Mossa and C. Gallet. 2000. A propos d'une entité corso-sarde du Genévrier nain. Bull. Mens. Soc. Linn. Lyon. 69: 133-141.
- Lebreton, P., L. Garraud, and J. M. Genis. 2013. Contribution à la connaissance écologique du Genévrier thurifère, comparé aux autres espèces du genre *Juniperus* dans le sud-est de la France continentale. Ecol. Mediterr. 39(1): 55-59.
- Linné, C. 1753. Species plantarum: exhibentes plantas rite cognitatas ad genera relatas, cum differentiis specificis, nominibus trivialibus, synonymis selectis, locis natalibus, secundum systema sexuale digestas, 2. Laurentii Salvii, Stockholm.
- Loudon, J. C. 1838. Arboretum et fruticetum Britannicum, or: the trees and shrubs of Britain ... Author, London.
- Marković, M., D. Pavlović-Muratspahić, M. Matović, A. Marković and V. Stankov-Jovanović. 2009. Aromatic flora of the Vidlič Mountain. Biotechnol. Equip. 23(2): 1225-1229.
- Marschall von Bieberstein, F. A. 1808. Flora taurico-caucasica exhibens stirpes phaenogamas, vol. 2. Typis Academicis, Kharkov.

- Matthews, J. R. 1930. Recent additions to the list of Perthshire plants. Trans. Perthshire Soc. Nat. Sci. 8: 184-210.
- McNeill, M. 1910. Colonsay, one of the Hebrides, its plants: their local names and usses - legends, ruins, and place-names - Gaelic names of birds, fishes, etc. - climate, geological formation, etc. David Douglas, Edinburgh.
- MDH. 2023. Moscow Digital Herbarium Moscow State University, Moscow. Retrieved from <https://plant.depo.msu.ru/>
- Meurer, M. 1979. Vegetationskundliche Sukzessionsuntersuchungen einer Brandstelle im Südtiroler Langental. Jb. Ver. Schutz Bergwelt 44: 155-170.
- Michiels, H. G. 1996. Gebüschgesellschaften in den Hochlagen des Mangfallgebirges. Tuexenia 16: 73-85.
- Moldovan, I. 1971. Contribuții la cunoașterea vegetației lemnoase din muntele Gutii. Bul. Stiinț Univ. Baia Mare, Ser. B Mat. Fiz.-Chim. Biol. 3: 21-45.
- Muirhead, C. W. 1961. The flora of Easdale and the Garvellachs. Trans. Bot. Soc. Edinburgh 39: 316-342.
- Murtazaliev, R. A. 2009. Konspekt flory Dagestana 1. Ėpokha, Makhachkala.
- Mustafa, B., D. Nebija and A. Hajdari. 2016. Chemical composition of the essential oils of *Juniperus communis* subsp. *alpina* (Suter) Ćelak (Cupressaceae). Macedonian Pharm. Bull. 62(suppl.): 479-480.
- NATURALIS. 2024. Naturalis Bioportal. <https://bioportal.naturalis.nl/>
- Neilreich, A. 1859. Flora von Nieder-Oesterreich, Eine Aufzählung und Beschreibung der im Erzherzogthume Oesterreich unter der Enns wild wachsenden oder in Grossem gebauten Gefässpflanzen nebst einer pflanzengeographischen Schilderung dieses Landes. Carl Gerold's Sohn, Vienna.
- Nikolovski, T. 1970. Waldgesellschaften und Waldbäume an der oberen Grenze der Verbreitung in verschiedenen Gebirgssystemen der SR-Mazedonien. Mitt. Ostalpin-Dinar. Ges. 11: 151-160.
- Ninot, J. M. and E. Carrillo. 2019. Contribució al coneixement geobotànic de les comunitats de *Juniperus sabina* i de *Juniperus communis* (Cupressaceae) als Pirineus catalans. Butll. Inst. Catalana Hist. Nat. 83: 159-174.
- NMW. 2023. National Museum Wales. *Juniperus communis* L. Retrieved from [https://naturalhistory.museumwales.ac.uk/corespecies/CMS/Resources/pdfs/Juniperus\\_communis/Juniperus\\_communis.pdf](https://naturalhistory.museumwales.ac.uk/corespecies/CMS/Resources/pdfs/Juniperus_communis/Juniperus_communis.pdf)
- Nyman, C. F. 1881. Conspectus florae europaeae, seu enumeratio methodica plantarum phanerogamarum Europae indigenarum, indicatio distributionis geographicae singularum etc. Typis Officinae Bohlinianae, Örebro.
- Oborny, A. 1885. Flora von Mähren und österr. Schlesien enthaltend die wildwachsenden, verwilderten und häufig angebauten Gefässpflanzen. W. Burkart, Brno.
- Operta, A., M. Hasanović and I. Mahmutović-Dizdarević. 2018. Geographic monitoring of forest biodiversity in Bosnia and Herzegovina. Regionalne konferencije "Životna Sredina ka Evropi". Beograd.
- Parlatore, F. 1868. Flora italiana, ossia descrizione delle piante che nascono salvatiche o si sono insalvatiche in Italia e nelle isole ad essa adiacenti; distribuita secondo il metodo naturale, 4. Successori Le Monnier, Florence.
- Perez Latorre, A. V. and Cabezudo, B. 2011. Gimnospermas. In: G. Blanca, B. Cabezudo, M. Cueto, C. Morales and C. Salazar (eds.). Flora Vascular de Andalucía Oriental. 2nd ed (pp. 77-91). Universidades de Almeria, Granada, Jaen y Malaga, Granada.
- Petrović, D., S. Hadžiablahović, S. Vuksanović, V. Mačić, Đ. Milanović and D. Lakušić. 2019. Katalog tipova staništa od interesa za EU u Crnoj Gori. EuropeAid/137266/DH/SER/ME, Podgorica-Banja, Luka-and Beograd.
- Peyronel, B. and V. Dal Vesco. 1971. Notes sur les plantes rares ou critiques du val de Cogne (Grand Paradis). VI. Stations nouvelles d'*Astragalus centralpinus* Br.-Bl. Bull. Soc. Flore Valdôtaine 25: 11-19.
- Pignatti, S. 1982. Flora d'Italia 1. Edagricole, Bologna.

- Pop, E. 1939. Semnalări de tinoave și de plante de mlaștini din România, II. Bul. Grăd. Bot. Univ. Cluj 19(3-4): 109-167.
- POWO. 2023. Plants of the World Online. Royal Botanic Gardens Kew. Retrieved from <https://powo.science.kew.org/>
- Pursh, F. 1813. Flora Americae Septentrionalis; or, a systematic arrangement and description of the plants of North America, 2. White, Cochrane and co., London.
- Presl, C. 1822. Deliciae pragenses, historiam naturalem spectantes. Sumtibus Calve, Prague.
- Preston, C. D., D. A. Pearman and T. D. Dines. 2002. New atlas of the British and Irish flora. Oxford University Press, Oxford.
- RBGE. 2023. Royal Botanic Garden Edinburgh. Herbarium catalogue. Retrieved from <https://data.rbge.org.uk/search/herbarium/>
- Rechinger, K. H. 1933. Ergebnisse einer botanischen Reise nach Bulgarien. Magyar Bot. Lapok 23(1-6): 5-58.
- RECOLNAT. 2023. e-Recolnat program. Retrieved from <https://www.recolnat.org>
- Ribbons, B. W. 1972. Reports. Filed meeting 1970. Italy and Austria. Watsonia 9(1): 63-65.
- Richter, K. 1890. Plantae Europaeae. Enumeratio systematica et synonymica plantarum phaenerogamicarum in Europa sponte crescentium vel mere inquilinarum, 1. Wilhelm Engelmann, Leipzig.
- Rikli, M. 1936. Über den Zwergwacholder. Ber. Schweiz. Bot. Ges. 46: 338-354.
- Rivas Goday, S. and J. Borja. 1961. Estudio de la vegetación y flórula del macizo de Gúdar y Javalambre. Anales Inst. Bot. Cavanilles 19: 1-550.
- Rivas-Martínez, S., T. E. Díaz, F. Fernández-González, J. Izco, J. Loidi, M. Lousã and A. Penas. 2002. Vascular plant communities of Spain and Portugal. Addenda to the syntaxonomical checklist of 2001. II. Itinera Geobot. 15: 5-922.
- RJB. 2023. Herbario de fanerogamia del Real Jardín Botánico de Madrid. Retrieved from <http://colecciones.rjb.csic.es>
- Römer, J. 1911. Ein beachtenswertes, pflanzengeographisches Gebiet des Burzenlandes. Verh. Mitth. Siebenbürg. Vereins Naturwiss. Hermannstadt 61: 1-55.
- Sanio, C. 1883. Über die Varietäten von *Juniperus communis* L in der Flora von Lyck in Preussen. Deutsche Bot. Monatsschr. 1: 49-52.
- Schittengruber, K. 1960. Über das Vorkommen einiger Cetraria-Arten im Gebiete der Zentralalpen von Steiermark. Mitt. Naturwiss. Ver. Steiermark 90: 113-121.
- Schulz, C., P. Knopf and T. Stützel. 2005. Identification key to the Cypress family (Cupressaceae). Feddes Repert. 116: 96-146.
- Schur, P. J. F. 1851. Beiträge zur Kenntniss der Flora von Siebenbürgen. Verh. Mitth. Siebenbürg. Vereins Naturwiss. Hermannstadt. 10: 167-171.
- Sennen, F. 1908. Plantes d'Espagne. Années 1906 & 1907. Bull. Acad. Int. Géogr. Bot. 18(229): 449-480.
- Siljak-Yakovlev, S., F. Pustahija, E. M. Šolić, F. Bogunić, E. Muratović, N. Bašić, O. Catrice and S. C. Brown. 2010. Towards a genome size and chromosome number database of Balkan Flora: C-Values in 343 Taxa with Novel Values for 242. Adv. Sci. Lett. 3: 190-213.
- Simonkai, L. 1886. Erdély edényes flórájának helyesbitett foglalata. Királyi Magyar Természettudományi Társulat, Budapest.
- Simovski, B. 2013. Woody plants of the National Park Mavrovo. Republic of Macedonia International Scientific Conference Forest Research Institute at the Bulgarian Academy of Sciences, Sofia.
- Simovski, B. 2015. Рецензија за оцена на докторската дисертација Природни сукцесии во шумите од Националниот парк „Маврово“. Билтенна Универзитетот „СВ. Кирил и методиј“ 1101: 338-349.
- Shevera, M. V. and M. M. Fedoronchuk. 2011. Типифікація видів родин Cupressaceae Bartl. та Pinaceae Lindl., описаних з території України. Sci. Herald Chernivtsy Univ. Biol. 3(4): 464-466.
- Soriano, I. 1998. La vegetació de la serra de Moixeró i el massís de la Tosa d'Alp (Pirineus orientals). Acta Bot. Barcinon. 47: 5-400.

- Spach, E. 1841. Revision des *Juniperus*. Ann. Sci. Nat. Bot. 16: 282-305.
- Stace, C. 2010. New Flora of the British Isles. 3rd edn. Cambridge University Press, Cambridge.
- Steven, C. 1857. Verzeichniss der auf der taurischen Halbinsel wildwachsenden Pflanzen. Bull. Soc. Imp. Naturalistes Moscou 30: 325-398.
- SVNP. 2023. Sjevneri Velebit National Park. Retrieved from <https://np-sjevneri-velebit.hr>
- Takhtajan, A. L. 1954. Flora Armenii 1. Akademia Nauk, Yerevan.
- Takhtajan, A. L. 2003. Konspekt flory Kavkaza 1. KMK, St. Petersburg.
- Theurillat, J. P., M. Di Musciano, O. Duckert and C. Béguin. 2021. Symphytosociology, a tool for landscape monitoring: a case study from the Swiss Alps. *in* Tools for landscape-scale geobotany and conservation (pp 267-283). F. Pedrotti and E. Owen, eds., Springer Nature, Cham.
- Thomas, P. A., M. El-barghathit and A. Polwart. 2007. Biological flora of the British Isles: *Juniperus communis* L. J. Ecol. 95: 1404-1440.
- Tison, J. M. and B. Foucault. 2014. Flora Gallica. Flora de France. Biotope, Mèze.
- Turland, N. J., J. H. Wiersema, F. R. Barrie, W. Greuter, D. L. Hawksworth, P. S. Herendeen, S. Knapp, W. H. Kusber, D. Z. Li, K. Marhold et al. 2018. International code of nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017. Regnum Veg. 159. Koeltz Botanical Books, Glashütten.
- UniVegE. 2023. Herbiers Universitaires de Clermont-Ferrand. Retrieved from <http://db.herbiers.uca.fr>
- Van der Merwe, M., M. O. Winfield, G. M. Arnold and J. S. Parker. 2000. Spatial and temporal aspects of the genetic structure of *Juniperus communis* populations. Mol, Ecol. 9: 379-386.
- Vargas, P. 2003. Molecular evidence for multiple diversification patterns of alpine plants in Mediterranean Europe. Taxon 52: 463-476
- Vidakovic, M. 1991. Conifers: morphology and variation. Graficki Zavod Hrvatske, Zagreb.
- Vierhapper, F. and H. F. Handel-Mazetti. 1905. Exkursion in die Ostalpen. Führer zu den wissenschaftlichen Exkursionen des II. Internationalen Botanischen Kongresses, Wien.
- Watt, G. 1931. Digest of the proceedings of the Society. Glasg. Nat. 9: 75.