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Redefining the phylogenetic relationships of European *Angelica* (Apiaceae) species

Angelica (Apiaceae) is a large complex genus with high morphological diversity. The many taxonomic treatments explain the controversy regarding the number of European species, which range from 4 to 10. Molecular methods have unraveled the complicated Asian and American taxonomies; however, no comprehensive molecular study has been conducted on the European taxa. We aim to determine the number of different European *Angelica s. l.* taxa and their relationship within the Selineae tribe by conducting Maximum Likelihood (ML) and Bayesian Inference (BI) analyses based on the nuclear Internal Transcribed Spacer (ITS) and haplotype networks by TCS and neighbor-net based on the plastid trnL. Three separate Iberian species (*A. angelicastrum*, *A. razulii*, and *A. pyrenaea*) formed the new Iberian Angelica clade, which is sister to the *Archangelica* clade. Although morphologically different, *A. pachycarpa* cannot be differentiated from *A. angelicastrum* by molecular methods, casting new doubts the existing taxonomies. Molecular evidences suggest that *A. heterocarpa* should be considered an estuary forma of *A. sylvestris*. The East and West *A. sylvestris* subclades support the subspecies *A. sylvestris* ssp. *elatior* and *A. sylvestris* ssp. *villosa* (including *A. heterocarpa*). Our evidences support the classification of *A. palustris* as *Ostericum palustre*.

Keywords: *Angelica*, *Archangelica*, Europe, Iberian Peninsula, Internal Transcribed Spacer (ITS), *Ostericum*, trnL

Introduction

Apiaceae Lindl. (1836) (=Umbelliferae nom. cons.) is a large family formed by 300-466 genera and 3000-3820 species (Constance 1971; Pimenov and Leonov 1993; Downie et al. 2001; Plunkett et al. 2018) which are systematized into four monophyletic subfamilies: Apioideae Drude, Azorelloideae G.M.Plunkett & Lowry (2004) (Hydrocotyloideae Link in part), Mackinlayoideae G.M.Plunkett & Lowry (2004) (Hydrocotyloideae Link in part) and Saniculoideae (Chandler and Plunkett 2004; Plunkett et al. 2004, 2018). The large monophyletic Apioideae subfamily has been

traditionally divided by Drude (1898) into a group of tribes and subtribes that have been often subjected to morphological (e.g. Downie et al. 2000; Downie et al. 2001; Calviño and Downie 2007), serological (e.g. Shneyer et al. 1991) and molecular studies (e.g. Katz-Downie et al. 1999), which have found the tribes not to be monophyletic. Nevertheless, the comprehensive molecular studies of Downie et al. (2001) and Downie et al. (2010) on the Apioid superclade found 10 monophyletic tribes based on nuclear and plastid data: Aciphylleae M.F. Watson & S.R. Downie (2000), Bupleureae Spreng. (1820) (=*Bupleurum* L. (1753) clade), Careae Baill. (1879), Echinophoreae Benth. (1867), Heteromorpheae M. F. Watson & S. R. Downie (2000), Oenantheae Dumort. (1827), Pleurospermeae M. F. Watson & S. R. Downie (2000), Pyramidoptereae Boiss. (1872), Scandiceae Spreng. (1820) and Smyrnieae Spreng. (1820).

Within tribe Selineae (Apioid superclade), the genus *Angelica* L. (1753) *sensu lato* (s.l.) is the most taxonomically complex and includes approximately 90–120 species with high fruit diversity distributed throughout the temperate regions of the North hemisphere with a centre of differentiation in Japan and East Asia (Hiroe and Constance 1958; Pimenov 1978; Gutiérrez Bustillo 1981; Downie et al.2001; She et al. 2005; Liao et al. 2012, 2013; Plunkett et al. 2018). *Angelica* s.l. has been subjected to recurrent changes in systematics (e.g. Drude 1898; Koso-Poljansky 1916; Feng et al. 2009) due to both the difficulties in discriminating this genus from others of its family without using fruit morphology and the existence of many synonymies as a consequence of the different conceptions of this genus and its species (Gutiérrez Bustillo 1981; Liao et al. 2020). Hence, taxa from other genera such as *Archangelica* Hoffm. (1814), *Coelopleurum* Ledeb. (1844), *Czernaevia* Turcz. ex Ledeb. (1844), or *Ostericum* Hoffm. (1816), which were historically considered *Angelica* species, have been reclassified by some authors based on features of fruits, pollen and other structures

(see Downie et al. 2000; Deyu et al. 2004; Spalik et al. 2004; Feng et al. 2009; Liao et al. 2013).

In this context, the phylogenetic studies based on the nuclear maker Internal Transcribed Spacers (ITS) and other plastid marker conducted by Feng et al. (2009) and Xue et al. (2007) shed some light on the polyphyletic character of Angelica, first on the Asian *Angelica* sensu stricto (s.s.) species (Xue et al. 2007; Feng et al. 2009) and later on a broader sample of species including American and some European representatives (Downie et al. 2010; Liao et al. 2012; Liao et al. 2020). These analyses revealed that even when some taxa included in genera such as *Coelopleurum*, *Czernaevia*, *Ostericum* Hoffm. pro parte, *Sphenosciadium* A. Gray (1865), *Melanosciadium* H.Boissieu (1902) or *Pimpinella* L. (1753) are reclassified as *Angelica* L., this would be a polyphyletic genus, since some of the taxa classically considered as *Angelica* were found in at least four major clades (the Acronema and Sinodielsia Clades and the Selineae and Tordyliinae tribes) (Downie et al. 2010).

The number of European genera and species within the Apiaceae family has been much discussed throughout history (see Table 1, Figure1 and Table 2). More specifically, the number of *Angelica* different species ranges from 6 to 10 depending on the number of synonymies and satellite genera considered by some authors (e.g. Lange 1880; Cannon 1968; Gutiérrez Bustillo 1981; Castroviejo and Gutiérrez Bustillo 2003; Hand 2011). Thus, the two most relevant sources who treated all the European taxa, Cannon (1968) and The Euro+Med Plantbase Project (Hand 2011) are only coincidental in the recognition of 6 European species, 2 of which are distributed exclusively in the Iberian Peninsula. These differences in part are due to synonymies of 3 Iberian and 1 Pyrenean taxa: The Euro+Med Plantbase Project (Hand 2011) considers the taxa *Angelica angelicastrum* (Hoffmanns. & Link) Coutinho (1913) (=*Selinum*

angelicastrum Hoffmanns. & Link (1834)) and *Angelica laevis* J.Gay ex Fisch. & C.A.Mey (1843) synonyms of *Angelica major* Lag. (1816), meanwhile Cannon (1968) does not even treat *A. major*, hence considering the latter two taxa as independent species. Moreover, Cannon (1968) and Flora Iberica (Gómez 2003) systematize *Angelica pyrenaea* (L.) Spreng. (1813) within *Selinum* L. (1762), which would then be homotypically synonymous to *Epikeros pyrenaeus* (L.) Raf. (1840) and *Seseli pyrenaeum* L. (1753). Another source of discordance is the rare species *Angelica palustris* Hoffm. (1814), which is endemic to eastern Europe and western Asia (Dittbrenner et al. 2005). This species, which exhibits a wetland preference (Dittbrenner et al. 2005), is classified within *Ostericum* Hoffm. (1816) as *Ostericum pratense* Hoffm. (1816) (=*Ostericum palustre* (Besser) Besser (1822)) by The Euro+Med Plantbase Project and other authors (e.g. Gutiérrez Bustillo 1981; Hand 2011; Liao et al. 2020), but not by Cannon (1968). Conversely, the French endemic species of the Atlantic coast estuaries of Loire, Charente, Gironde, and l'Adour et de la Nive, *Angelica heterocarpa* J.Lloyd (1860), has been consistently considered a separated species from *Angelica sylvestris* L. (1753) despite their morphological resemblance (Cannon 1968; Reduron 2007; Hand 2011; Cianfaglione and Bioret 2018).

Besides *O. pratense* and *A. pyrenaea*, the Iberian and Pyrenean *Angelica* taxa are an important source of disagreement as Lange (1880) listed 3 endemisms (*A. razulii* Gouan (1773), *A. major* and *A. pachycarpa* Lange (1864) (Table 2)), while Cannon (1968) cited only 4 *Angelica* species (*A. angelicastrum*, *A. razulii* , *A. laevis*, and *A. pachycarpa*) and posterior morphological studies of herbarium samples by Gutiérrez Bustillo (1981) and Castroviejo and Gutiérrez Bustillo (2003) referred to only 3 species as they consider *A. angelicastrum*, *A. laevis* and *A. reuteri* Boiss. (1856) as synonymous to *A. major*.

All these different classifications and synonymies based on morphological studies suggest that the diversity and systematics of the European *Angelica* s. l. species would benefit from molecular phylogenetic studies, especially the Iberian *Angelica*. However, up to this date, despite the demonstrated utility of these kinds of analyses in clarifying the taxonomy and phylogenetic relationships in the east Asian and North American *Angelica* taxa (Liao et al. 2013; Liao et al. 2020), no comprehensive molecular focus on the European *Angelica* species has been conducted. In this context, we aim to conduct the first comprehensive phylogenetic molecular study of the European *Angelica* s.l. taxa to determine the real number of European species and their phylogenetic relationships within the Selineae tribe by performing phylogenetic analyses based on nuclear and plastid molecular markers.

Material and Methods

Sample collection, DNA extraction and amplification

Leaf tissue from 51 samples of 10 *Angelica* s. l. taxa and 1 sample of *Sanicula europaea* L. (1753) from the Iberian Peninsula and Central and East Europe was collected for this study (see Table 3 and Figure 2). The leaf material was preserved in silica gel during transportation and before DNA extraction. DNA extraction was conducted using the Qiagen DNeasy® Plant Minikit (Qiagen Inc., Valencia, CA, USA), after which samples were kept at -20ºC before amplification.

The nuclear molecular marker Internal Transcribed Spacer (ITS) and the plastid marker trnL were amplified by Polymerase Chain Reaction (PCR). The nuclear sequences of ITS1, 5.8 S and ITS2 were amplified using the pairs of primers ITS1 and ITS4 (White et al. 1990) and 17SE and 26SE (Sun et al. 1994), while the plastid sequence intron trnL (UAA) was amplified with the Lc and Ld primers (Taberlet et al.

1991). The PCR mix consisted in a total volume of 25 µL containing 2.5 µL of 10x PCR buffer (Biotools), 2mM of MgCl2, 0,2 mM of each dNTP (Biotools), 0,5 µM of primers, 1 U of Taq polimerase (Biotools) and 10-20ng of DNA. The PCR consisted in an initial denaturalization at 95ºC for 2 minutes, followed by 35 cycles formed by a denaturalization phase at 95ºC during 1 minute, an annealing phase at 55ºC for 1 minute and an elongation phase at 72ºC during 2 minutes, followed by a final elongation of 12 minutes at 72ºC. Amplicons were sequenced using the Sanger method in the facilities of Macrogen Inc. (Netherlands).

Phylogenetic analyses

The obtained new sequences were reviewed an edited in Geneious 2019 1.3. (Kearse et al. 2012). Double peaks were considered to be "real" when it occurred in both forwardly and reversely amplified sequences and the lower peak reached at least a third of the height of the higher peak. Bases and ambiguities were coded following the International Union of Pure and Applied Chemistry (IUPAC) criteria (International Union of Pure and Applied Chemistry (IUPAC) 2020).

Two different ITS data sets were created for this study: the European ITS dataset and the Apioideae ITS dataset. The phylogenetic relationships among the recognized European *Angelica* s. l. species was inferred by analysing the newly obtained ITS sequences of the sampled individuals plus sequences from *Angelica* sequences from previous studies (e.g. Liao et al. 2020) available at GenBank of taxa considered to be European species (see Appendix for more detail). This dataset included sequences of the type of *Angelica* (*A. sylvestris*), the sequences of 10 species with European distribution and the Saniculoideae species *Sanicula europaea* L. (1753) as outgroup. *Sanicula europaea* was chosen as outgroup for this dataset since this included species from genera that have been previously found in the Selineae tribe and in the Acronema clade

(e.g. Liao et al. 2013; Liao et al. 2020) and a species from this genus has been successfully used in a similar phylogenetic analysis focusing on East Asia species, which comprised *Angelica* and *Ostericum* species (Huajie et al. 2007). In a wider context, the Apioideae ITS dataset was created so as to infer the relations of the European Angelica species with the rest of *Angelica* and Apioideae taxa. This dataset was formed by the sequences of the nuclear regions ITS1, 5.8 S and ITS2, whenever available, of the type species of the genera of the Apioideae subfamily sensu Downie et al. (2001). The Apioideae ITS dataset included sequences of taxa belonging to the Selineae tribe and the Acronema, the Arracacia and the Perennial Endemic North American Apiod (P.E.N.A) clades as described in previous studies (e. g. Downie et al. 2010; Liao et al. 2013), since these have been included in previous studies focused on the genera *Angelica* and *Ostericum* (e.g. Liao et al. 2013) (see Appendix 1 for sequences detailes). The inclusion of various sequences of the same species generated in different studies was favoured to detect potential misidentification among Genbank sequences and minimize the risk of extracting incorrect conclusions. Whenever a sequence of the type species of one genus was not available or was too short, sequences of several species of that genus where included in the analyses. Finally, the intron trnL (UAA) dataset (hereinafter called trnL dataset) consisted in 44 new intron trnL (UAA) sequences of the sampled taxa plus sequences of the European taxa available at Genbank from previous studies (see Appendix 1).

These datasets were aligned using the MUSCLE alignment method in Jalview 2.11.1.3 (Edgar 2004; Barton et al. 2009). The obtained alignments of the ITS and trnL datasets were manually edited before the diagnosis of best fitting nucleotide substitution model by the corrected Akaike Information Criterion (cAIC) using jModelTest 2.1.10 (Akaike, 1974; Darriba et al. 2012). The best fitting model for the Apioideae ITS

dataset was the Symmetrical model with Gamma distribution (SYM+G) (Zharkikh 1994) and the General Time Reversible with Gamma distribution (GTR+G) (Tavaré 1986; Yang 1994) for the European ITS dataset, while the best model for the trnL alignment was Felsenstein 1981 with Gamma distribution (F81+G) (Felsenstein 1981; Yang 1994).

The phylogenetic relationships of the European *Angelica* between them and with the rest of Apiaceae were inferred by two different methods: Bayesian Inference (BI) and Maximum Likelihood (ML). The BI analyses consisting of 2 MCMC runs of 6 chains (5 hot chains and 1 cold chain) for 10000000 generations with a temperature of 0.1 and a burn-in fraction of 0.25 were performed in Mr. Bayes 3.2. (Tuffley and Steel 1997; Yang and Rannala 1997; Larget and Simon 1999; Mau et al. 1999; Huelsenbeck and Ronquist 2001; Altekar et al. 2004; Ronquist et al. 2012). The posterior probability (PP) was calculated to infer the statistical support of the branches of the obtained topologies (Metoropolis et al. 1953; Hastings 1970; Geyer 1991). On the other hand, ML analysis performed in IQtree (Saitou and Nei 1987; Nguyen et al., 2015; Trifinopoulos et al. 2016) consisted of an heuristic Tree Bisection Reconnection (TBR) search, Nearest-Neighbor Interchange (NNI) full-tree rearrangements and 10000 ultrabootstrap (BT) replications in the case of the European ITS dataset and 5000 ultrabootstrap replications in the case of the Apioideae ITS dataset for the branch support analysis of the obtained topologies (Robinson 1971; Moore et al. 1973; Minh et al. 2013; Chernomor et al. 2016; Hoang et al. 2018). Branches with less than 50% of support by PP or BT were collapsed in the final consensus tree.

Phylogenetic relationships among the European species were also inferred by plastid-based haplotype network analyses. A phylogenetic network based on distances was generated using the neighbour-net analysis of Splitstree 14.4.4 (CBOL Plant

Working Group et al. 2006). The statistical branch support was of this network was calculated by 10000 bootstrap repetitions. The Fitness of the model was estimated by the index Fit. A gene genealogy was estimated by the generation of a genealogy based on Templeton, Crandall and Sing (TCS) cladistics method in PopART 1.7 (Clement et al. 2002).

Results

The main features of the European and Apioideae ITS and trnL dataset alignments (excluding the outgroup taxa) used for this study are resumed in Table 4. The trnL dataset of the European *Angelica* species presented substantially less parsimomious-informartive sites (17) than the ITS European *Angelica* species dataset (114), although it should be noted that the former presents 1 less *Angelica* taxa and included less sequences of the studied taxa. On the other hand, the Apioidae ITS dataset presented 410 parsimomious-informartive sites and included 67 *Angelica* taxa.

The topology obtained after the phylogenetic analyses of the European ITS dataset (Figure 3) shows two major clades (PP: 100, BT: 100): the clade A (PP: 100, BT: 95) formed by *A. sylvestris* (ASYL1-8 and An 334-555), *A. razulii* (ARAZ 1-6), *A. reuteri* (AREU1), *A. laevis* (ALAE 1-8), *A. pyrenaea* (APYR 1-2), *A. major* (AMAJ 1-4), *A. archangelica* (AARC1), *A. decurrens*, *A. heterocarpa* (AHET 1-3), *A. lignescens* and *A. pachycarpa* (APA 1-8) and clade O (PP: 100, BT: 100) formed exclusively by *O. pratense* and *O. palustre* (APAL 1-4) sequences. The major clade A is subdivided into four subclades: the subclade AS (PP: 100, BT: 99), formed by sequences of *A. sylvestris* (ASYL1-8 and An 334-555) and *A. heterocarpa* (AHET 1-3); the subclade AIB (PP: 94, BT: 87), which comprises the subclade AI (PP: 96, BT: 88) formed by the Iberian endemisms (*A. razulii* (ARAZ 1-6), *A. reuteri* (AREU1), *A. laevis* (ALAE 1-8), *A. pyrenaea* (APYR 1-2), *A. major* (AMAJ 1-4) and *A. pachycarpa* (APA 1-8)) and the

subclade AR (PP: 100, BT: 97), formed by samples of *A. archangelica* (AARC1) and *A. decurrens*; the subclade AL1 (PP: 74, BT: 71), which comprises sequences of *A. lignescens* from the Azoric islands of Pico and Terceira; and the subclade AL2 (PP: 55), formed by sequences of *A. lignescens* from the azoric islands of Flores, Faial and Sao Miguel. The subclade AI is subdivided into 3 clades of Iberian endemism. The individuals of *A. razulii* (ARAZ 1-6) grouped in their own highly-supported independent clade (PP: 100, BT: 95). Similarly, the individuals of *A. pyrenaea* (APYR 1-2) generated their own clade (PP: 81, BT: 57), whereas the individuals of *A. reuteri* (AREU1), *A. laevis* (ALAE 1-8), *A. major* (AMAJ 1-4) and *A. pachycarpa* (APA 1-8) grouped in a single highly-supported subclade (PP: 100, BT: 98), in which our individual of *A. reuteri* (AREU1) formed a highly-supported subclade (PP: 98, BT: 96) with samples of cultivated *A. pachycarpa*. The subclade AR was formed one single clade comprising samples of *A. archangelica* (AARC1) and *A. decurrens*, which did not form species-exclusive inner subclades. The *A. sylvestris* subclade AS is divided into two different sister subclades: the ASH subclade (PP: 100, BT: 99) and the AEC subclade (PP: 99, BT: 78). The ASH subclade grouped together samples from individuals of *A. heterocarpa* (AHET1-3 and Genbank sequences) and from individuals of *A. sylvestris* sampled in the East Pyrenees (ASYL7-9), the Cantabrian Mountains (ASYL1-2 and ASYL4) and Central France (ASYL3). On the other hand, the AEC subclade is formed by individuals of *A. sylvestris* from Central and East Europe.

The phylogenetic relationships of these species within Apioideae were clarified by the results of the analysis of the Apioideae ITS dataset (see Figure 4-8). The European samples were distributed in the Eurasian *Angelica* clade (PP: 99, BT: 72; see Figure 4), in the Archangelica-Iberian clade (PP: 90, BT: 81; see Figure 5) and in the Acronema (PP: 100, BT: 100; see Figure 7). The sampled *A. sylvestris* and *A.*

heterocarpa (AHET 1-3) individuals were found in the *A. sylvestris* clade (PP: 100, BT: 100; see Figure 5) of the Eurasian *Angelica* clade. Within the *A. sylvestris* clade, the highly-supported sister subclades which grouped together on the one side the *A. heterocarpa* (AHET 1-3) and the Iberian *A. sylvestris* samples (PP: 100, BT: 100) and on the other side the Central-East Europe *A. sylvestris* samples (PP: 99, BT: 100) can also be found. The *A. sylvestris* clade is also sister to many other clades of the Eurasian *Angelica* Clade (PP: 72, BT: 94), including the two *A. lignescens* clades (AL1 PP: 96, BT: 100 and AL2 PP: 100, BT: 100).

The Iberian endemic species and the sampled *A. archangelica* were found in the Archangelica-Iberian clade (see Figure 5), which is sister (PP: 65, BT: 79) to the Eurasian *Angelica* Clade and the North American Clade. This clade is subdivided in two highly-supported sister clades: the Iberian clade (PP: 100, BT:100) and the Archangelica clade (PP:95, BT:99). The Archangelica clade comprised European (i. e. *A. archangelica*), Asian (i. e. A. *decurrens* B. Fedtsch. (1909), *A. brevicaulis* B. Fedtsch. (1909) and *Angelica tschimganica* V.N. Tikhom. (1967)) and American species (i. e. *A. ampla* A. Nelson (1898) and *A. atropurpurea* L. (1753)), while the Iberian clade was formed exclusively by Iberian endemism (*A. razulii* (ARAZ 1-6), *A. reuteri* (AREU1), *A. laevis* (ALAE 1-8), *A. pyrenaea* (APYR 1-2), *A. major* (AMAJ 1-4) and *A. pachycarpa* (APA 1-8)). Within the Archangelica clade, the American species *A. ampla* and *A. atropurpurea* formed a moderately-supported clade (PP: 55, BT: 78), which comprised two species-exclusive highly supported clades: the *A. ampla* clade (PP: 81, BT: 100) and the *A. atropurpurea* clade (PP: 99, BT: 100). Nevertheless, it should be noted that the partial *A. ampla* sequence AH006065 did not form part of any of those clades. The sequences of *A. archangelica* and *A. decurrens* did not form species-exclusive clades, neither the *A. brevicaulis* and *A. tschimganica* sequences,

which were related with moderate support (PP: 63, BT: 66) to the rest of the clade. The *O. pratense* (=*A. palustris*) (APAL 1-4) samples were located in the *Ostericum* group (PP: 99, BT: 90, see Figure 7) within the Acronema clade, together with other *Ostericum* species and *A. anomala* Avé-Lall. (1999).

The haplotype networks obtained from the analyses of the European trnL dataset analyses present similar topologies (Figure 9 A and B). The neighbournet analysis reflects a well-fitting model (Fit: 92.685) which shows the Iberian clade is clearly separated (BT: 74.5) from the *A. sylvestris* and the *Ostericum palustre* clades and the *A. archangelica* sequence. In both analyses, the *Ostericum palustre* clade (BT: 99.4) is the most divergent clade, consistently with the nuclear data. The *A. sylvestris* clade included most of the *A. heterocarpa* sequences, as AHET2 (BT: 99.9) and ASYL1 (BT: 100) are separated from the rest of the group. A similar result was obtained with some Genbank sequences labelled as *A. sylvestris* in the TCS analysis (i.e. *A. sylvestris* GQ25456 and KF18351). Interestingly, the *A. archangelica* sequence is most closely related to the *A. sylvestris* clade than to the Iberian clade in both networks, in contrast with the results obtained with the nuclear data.

Discussion

The complicated taxonomic history of the genus *Angelica* is closely related to the morphology of these plants (Gutiérrez Bustillo 1982; Liao et al. 2020). The European taxa, particularly the Iberian taxa, have been subject to various systematic treatments based on their morphology (e.g. Cannon 1968; Liao et al. 2020), some of which propose different generic and subgeneric ascriptions for the same taxon. Our molecular analyses based on ITS and plastid markers have shed some light on the systematics of the European taxa, as they support the coexistence in Europe of an *Ostericum* taxon and 5 *Angelica* taxa belonging to two different highly supported clades within *Angelica* s.s.:

the "*A. sylvestris* clade" and the "Archangelica-Iberian clade".

The phylogenetic analyses of the *A. sylvestris* clade based on nuclear markers allowed greater resolution than the cpDNA analyses as it revealed the existence of two clear geographical subclades within the European *A. sylvestris*, the East clade and the West clade, and a group of undefined samples belonging to the North of Europe (i.e. Finland, Russia, Iceland and Poland), the North group. The West subclade of the *A. sylvestris* clade comprised two taxa which are closely related which inhabit Europe and the Macaronesia (Bensettiti et al. 2002; Intitution Adour 2010; Cianfaglione and Bioret 2018) and have been traditionally considered as separated species. *A. sylvestris* L. (1753) and *A. heterocarpa* Lloyd (1860). The samples of *A. heterocarpa* from the French Loire-Atlantic region were genetically indistinguishable from the *A. sylvestris* individuals of the East Pyrenees, the Cantabrian Mountains and Central France, although there exist evident morphological differences, such as the fruit morphology the presence of wide folioles and large umbel in *A. heterocarpa* (Bensettiti et al. 2002; Reduron 2007). In addition, the nuclear marker results are further supported by the plastid network, in which *A. heterocarpa* and *A. sylvestris* formed the same group. Given our results based on molecular evidence in which *A. heterocarpa* individuals are neither separated from the rest of *A. sylvestris*, nor they group in a *A. heterocarpa*-exclusive inner subclade, we believe the morphological differences do not support the consideration of *A. heterocarpa* as a distinct specie endemic to the French estuaries, but rather support the consideration of a forma of *A. sylvestris* associated to the estuaries of Loire, Charente, Gironde, and l'Adour et de la Nive. Moreover, the consideration of *A. heterocarpa* as a forma and the inclusion of this taxon within *A. sylvestris* concurs with both the intermediate *A. heterocarpa*- *A. sylvestris* forms observed by Metais et al. (2008) and the experimental generation of hybrids by Bernard (1991).

The existence of a West and an East *A. sylvestris* clade, which includes material collected in Central and East Europe, together with the observation about *A. sylvestris* variability (Gutiérrez Bustillo 1981; Reduron 2007) are compatible with the existence of at least two European subspecies of *A. sylvestris* that could correspond to the varieties *A. sylvestris* L. var. *villosa* (Lag.) Willkomm & Lange (1880) *A. sylvestris* L. var. *elatior* Wahlenb. (1814) as defined by Lange (1880). These authors specified that *A. sylvestris* var. *villosa* would occur in Asturias—North Iberian Peninsula—however, our data suggest that this subspecies occupies a broader range including not only Asturias, but also the French Atlantic coast, the Pyrenees and at least Central France. Furthermore, this distribution could be wider given the observation of Lagasca y Segura (1826) regarding the similarity between his *A. villosa* Lag. (1816) (=*A. sylvestris* var. *villosa* (Lag.) Willkomm & Lange (1880)) and the *A. sylvestris* of the British Islands and the report of this subspecies in the Basque Country (Reduron 2007). It should also be noted that according to our phylogenetic analyses based on molecular data, *A. heterocarpa* should be included within this subspecies. In this sense, the clade of *A. sylvestris* subp. *villosa* (the West *A. sylvestris* clade) could not correspond to the subspecies defined by Reduron (2007) *Angelica sylvestris* ssp. *bernardiae* Reduron (2007), as this taxon is supposed to show adaptations to the mountainous regions of Pyrenees and Jura and to be different from *A. heterocarpa*. On the other hand, the East *A. sylvestris* clade suggests the existence of *A. sylvestris* ssp. *elatior* in Central and Eastern Europe. However, we depend on limited samples to draw consistent conclusions about this clade, as the sequences from previous studies native to the same region were generated from cultivated individuals, therefore should be taken with caution. Hence, taking into account our results and the observation of Bernard (1991) about the caryology in this species, a more comprehensive study of these two taxa would be

required to understand the observed morphological differences and their taxonomic consistence.

Compellingly, the individuals of *A. sylvestris*, seem from a different taxon from the morphologically similar Macaronesian endemism *Angelica lignescens* Reduron & Danton (1998) found in Madeira and Azores Islands (Danton et al. 1997; Press and Dias 1998) thus, supporting the separation into two species made by Danton et al. (1997). Moreover, the sequences from *A. lignescens* generated two independent clades—the Flores, Faial and Sao Miguel Clade and the Pico and Terceira Clade—within *Angelica* s.s., bringing further support to the remarks of Schaefer et al. (2011) about the need of more in-depth studies to understand the biodiversity and origin of *A. lignescens*.

The Archangelica-Iberian clade presents the inner clade of Archangelica and the inner Iberian clade, retrieving thus a similar topology to that of Liao et al. (2020), although these authors only included two *A. pachycarpa* (APA 1-8) samples and a *A. razulii* (ARAZ 1-6) sample and did not describe an Iberian clade. This topology also revealed new insights into the subgeneric position of the Iberian endemisms, which has been treated differently through the years. De Candolle (1830) considered *Angelica* Hoffm. (1814) and *Archangelica* Hoffm. (1814) as separate genera and subdivided *Angelica* Hoffm. (1814) into the sections Euangelica and Peseudoangelica, belonging *A. razulii* and *A. sylvestris* to the former, and *A. pyrenaea* to the latter. On the other hand, Cannon (1968) systematised the Iberian endemisms, together with *A. sylvestris* (for this author =*A. major* (AMAJ 1-4) and *A. reuteri* (AREU1)) and *A. heterocarpa*, as part of the subgenus *Angelica*, while *A. archangelica* would belong to the subgenus *Archangelica* (Hoffm.) Maxim. Our results revealed that all Iberian endemisms have a close phylogenentic relationship with the Archangelica clade taxa, thus contradicting both De Candolle (1830) and Cannon (1968) regarding the subgeneric adscription of

these taxa. These results also suggest that the Iberian taxa could belong to the subgenus *Archangelica* (Hoffm.) Maxim; however, more research involving more genetic markers and more *Angelica* s. s. taxa is needed to verify this hypothesis and to clarify the subgeneric classification of this genus.

The Archangelica clade was similar to the Archangelica clade obtained by Liao et al. (2012). Within this group, the *A. archangelica* L. (1753) and the *A. decurrens* (Lebdeb.) B. Fedtsch (1909) sequences were not genetically distinguishable, as they formed part of the same clade. Thus, this topology supports the hypothesis of Cannon (1968), who argued that *A. decurrens* (Lebdeb.) B. Fedtsch (1909) was not a separate entity and should be systematised as *A. archangelica* ssp. *archangelica*. Nevertheless, it should be noted that most of the material from which the *A. archangelica* and the *A. decurrens* sequences were obtained, was cultivated, not natural. Therefore, although the current evidences are enough to determine that *Angelica tschimganica* (Klokov) V.N.Tikhom. (1967) is not synonymous to *A. decurrens*, more samples belonging to natural populations of are required to determine the taxonomic status of *A. archangelica* and *A. decurrens* species. Thus, we take a conservative approach and consider them to be closely related separate species.

The Iberian Clade, supported by ITS and cpDNA evidence, comprised 6 *Angelica* endemic taxa which have been defined through the years— *A. razulii* Gouan (1773), *A. reuteri* Boiss. (1856), *A. laevis* Gay ex Fisch., Mey. & Avé-Lall (1843), *A. major* Lag. (1816), *A. pachycarpa* Lange (1864) and *Angelica pyrenaea* (L.) Spreng (1813)—, but none of the *A. sylvestris* individuals collected in the Iberian Peninsula. Nevertheless, the ITS results indicate that only 3 of the 6 Angelica endemic taxa could be considered as separate species. The ITS phylogenies revealed that the Iberian taxa *A. reuteri*, *A. laevis*, *A. major* and *A. pachycarpa* form part of the same species, hence

supporting the hypothesis of Gutiérrez Bustillo (1981) and Castroviejo and Gutiérrez Bustillo (2003) who, based on morphological data, considered *A. laevis* and *A. reuteri* synonymous to *A. major* Lag. (1816) and contradicting that of Cannon (1968), who considered *A. major* and *A. reuteri* synonymous to *A. sylvestris*. However, it should be considered that *A. major* Lag. (1816) has been found to be an invalid name as *Angelica major* Gilib. (1782) is a posterior homonym of *A. archangelica* L. (1753) (Fernández Prieto et al. 2020), consequently, *A. reuteri* and *A. major* should be considered as synonyms of *Angelica angelicastrum* (Hoffmanns. & Link) Coutinho, Fl. Portugal: 455 (1913) as that is the valid name (Castroviejo 2002).

In addition to this pre-existing hypothesis, our phylogenetic topologies indicate that *A. pachycarpa* Lange (1864) is genetically indistinguishable from the *A. angelicastrum* group, which is rather surprising since *A. pachycarpa* has always been considered a separated taxon. The Iberian endemisms present similar leaf morphology, the *A. pachycarpa* leaves being completely glabrous and "slightly fleshy" with a bright green colouration, while *A. angelicastrum* group present dull green leaves with hairy nerves at the underside (Castroviejo and Gutiérrez Bustillo 2003; Reduron 2007). Moreover, *A. pachycarpa* can be found at coastal cliffs and lowlands of North West Iberian Atlantic coast, whereas the *A. angelicastrum* group taxa inhabit wet meadows up to 2100 m, mainly with siliceous substrates, of the Central and West Iberian Peninsula (Gutiérrez Bustillo 1981; Castroviejo and Gutiérrez Bustillo 2003). This information, together with the phylogenetic data, suggest that *A. pachycarpa* could be a subspsecies of *A. angelicastrum* adapted to the specific conditions of coastal areas. Nonetheless, neither the possibility of the ITS marker being incapable to distinguish two separated taxa, nor he possibility of *A. pachycarpa* being a coastal forma of *A. angelicastrum* can be ruled out given the current knowledge of these two taxa. We

favour the conservative approach and consider that *A. pachycarpa* should be systemised as a separated species. Compellingly, the ITS sequences of *A. pachycarpa* by Liao et al. (2020), which were obtained from cultivated samples in New Zealand—where naturalised *A. pachycarpa* populations have been reported (Constance 1967; Webb 1978)—, generated a subclade with our *A. reuteri* sample within the Iberian clade. *A. reuteri* Boiss. (1856) was first identified by Reuter as *A. laevis* J. Gay (1836) and later separated into two taxa by Boissier (Gutiérrez Bustillo 1981). A posterior morphological study by Gutiérrez Bustillo (1981) agreed with Reuter as this author considered *A. reuteri* a synonym of *A. major* (*A. angelicastrum*). This hypothesis is also supported by the phylogenetic position of *A. reuteri*, which conflict with the World Flora Online databases, which considers *A. reuteri* a synonym of *A. sylvestris* (World Flore Online (WFO) 2021).

The ITS-based analyses indicates that two other Iberian taxa, *A. razulii* Gouan (1773) and *Angelica pyrenaea* (L.) Spreng (1813), should be considered distinct species separated from the *A. angelicastrum* group. These results are unsurprising in the case of *A. razulii*, as this Pyrenean endemism found in wet meadows up to 2000-2600 m is easily distinguished from the rest of the Iberian endemism by the morphology of its folioles and has been recognised as a separate species by many authors (Lange 1880; Gutiérrez Bustillo 1981; Bernard 1991; Castroviejo and Gutiérrez Bustillo 2003; Reduron 2007). The case of the Iberian mountainous endemism *A. pyrenaea* is more surprising, since this taxon has been considered in the past as part of other genera like *Selinum* L. (1753) or *Peucedanum* L. (1753) (e.g. Lange 1880; Cannon 1968). Our results contradict the former hypothesis as the samples of this taxon are found in a different clade from that of *Selinum carvifolia* L. (1762), type-species of *Selinum,* thus suggesting that this taxon should not be classified as *Selinum pyrenaeum* (L.) Gouan

(1773). Therefore, our results contradict the current taxonomy of Flora Iberia (Gómez 2003) and the World Flora Online databases (WFO 2021) on the one hand, while giving further support to the findings of Spalik et al. (2004), who argued that this species should be included in *Angelica*. Additionally, our analyses revealed that *A. pyrenaea*, a high-mountain endemism (1400-2700 m) found in acid substrate of wet grassland of the North and Central Iberian mountainous systems (from the Pyrenees to the Central System) (Gómez 2003), has a close phylogenetic relationship with another two Iberian taxa with preferences for different habitats: the *A. angelicastrum* group—whose members can be found from seaside altitudes to 2100 m (Castroviejo and Gutiérrez Bustillo 2003)— and *A. razulii*, another Pyrenean endemism found at altitudes ranging from 700 m to 2600 m (Castroviejo and Gutiérrez Bustillo 2003).

The taxonomy of *A. palustris* (Besser) Hoffm. (1814) is complex, as this species has been ascribed to genera such as *Imperatoria* Besser, *Ostericum* Hoffm. and *Angelica* L., being to this date considered to belong in *Angelica* by The Euro+Med Plantbase Project and World Flore Online (Hand 2011; WFO 2022). Our ITS results do not support the current treatment of this species, as this taxon seems to be closely related to other species belonging to *Ostericum* (*Ostericum* clade sensu Liao et al. (2013)) placed in the Acronema clade, which is robustly separated from Selineae tribe. Hence, our ITS results support the hypothesis of Gutiérrez Bustillo (1981) and Liao et al. (2020) of including this taxon within *Ostericum* Hoffm. (1816) as synonymous to the type of this genus *Ostericum palustre* (Besser) Besser (1822).

The molecular studies conducted on American and Asian *Angelica* taxa based on ITS and plastid markers such as rps16, trnL-trnT or psbM-psbD has allowed to clarify their taxonomy (Huajie et al. 2007; Feng et al. 2009; Liao et al. 2012; Liao et al. 2013; Liao et al. 2020). The application of a similar methodology to the European *Angelica*

taxa has revealed that the Iberian endemic taxa are more closely related among them than with more widespread European taxa, even when their morphology suggests otherwise (e. g. *A. sylvestris* and *A. retueri*). Furthermore, the Iberian taxa are more closely related to the Asian, European and North American members of the Archangelica clade than to the taxa with a Euroasian distribution found in *A. sylvestris* clade (e.g. *A. heterocarpa*), opening new questions regarding the process of colonization of the European continent. At a more specific level, an similarly to what has been observed in the American and Asian taxa (Liao et al. 2012; Liao et al. 2013; Liao et al. 2020), the Iberian-Archangelica and the *A. sylvestris* clades aggregate an heterogeneous group of taxa with different foliar morphologies that have been considered separate, although the use of morphological characters has raised controversies long before the molecular methods were (e.g. Lange 1880; Cannon, 1968; Gutiérrez Bustillo 1981). This morphologically heterogeneous clades suggests that (1) new and further morphological and ecological analyses must be conducted on these species, especially on taxa belonging to the *A. angelicastrum* and *A. sylvestris* groups and (2) more molecular analyses must be conducted in order to determine whether ITS and the used cpDNA sequences have enough resolution to solve this genus or other nuclear and plastid markers are more adequeate.

Taxonomic treatment of European *Angelica* s.l. taxa

- ***Angelica archangelica* L., Sp. Pl.: 250 (1753)**

  =*Angelica officinalis* Moench, Methodus (Moench): 81 (1794)

  =*Archangelica archangelica* H.Karst., Deut. Fl. (Karsten): 843 (1882)

  =*Selinum archangelica* (L.) Vest Man. Bot. [Vest]: 501 (1806)

- ***Angelica angelicastrum*** **(Hoffmanns. & Link) Coutinho, Fl. Portugal: 455 (1913)**

≡*Selinum angelicastrum* Hoffmanns. & Link, Fl. Portug. 2: 428 (1834)

=*Angelica angelicastrum* (Hoffmanns. & Link) Coutinho, Fl. Portugal: 455 (1913)

=*Angelica hermini* Mariz, Bol. Soc. Brot. 12: 214 (1895)

=*Angelica major* Gilib., Fl. Lit. Inch. ii. 24 (1782), nom. illeg.

=*Angelica major* Lag., Gen. Sp. Nov. 13 (1816)

=*Angelica laevis* J.Gay ex Fisch. & C.A.Mey., Index Sem. Hort. Petrop. 9: 58 (1843)

=*Angelica reuteri* Boiss., Diagn. Pl. Orient., ser. 2, 3: 87 (1856)

- ***Angelica decurrens*** **B.Fedtsch., Consp. Fl. Turkestanicae [O.A. Fedchenko & B.A. Fedchenko] 3: 99 (1909)**

≡*Archangelica decurrens* var. *tschimganica* Klokov, Sched. Herb. Fl. As. Med. 10: 12 (1826)

=*Archangelica decurrens* Ledeb., Fl. Altaic. 1: 316 (1829)

=*Archangelica decurrens* var. *alpina* Regel & Herder, Bull. Soc. Imp. Naturalistes Moscou 39(II): 76 (1866)

=*Angelica decurrens* B.Fedtsch., Beih. Bot. Centralbl., Abt. 2. 28(2): 44 (1911)

=*Angelica archangelica* var. *decurrens* (Ledeb.) Weinert, Feddes Repert. 84(4): 309 (1973)

=*Angelica archangelica* subsp. *decurrens* (Ledeb.) Kuvaev, Bot. Zhurn. (Moscow & Leningrad) 66(7): 952 (1981).

- ***Angelica lignescens*** **Reduron & Danton, Acta Bot. Gallica 144(1): 186 (1998)**

- ***Angelica pachycarpa*** **Lange, Descr. Icon. Pl. Nov.: 7, pl. 9 (1864)**

- ***Angelica pyrenaea*** **(L.) Spreng., Umb. 62. (1813)**

  ≡*Seseli pyrenaeum* L., Sp. Pl.: 261 (1753)

  =*Epikeros pyrenaicus* (L.) Raf., Good Book: 51 (1840)

  =*Micrangelia pyrenaea* Fourr., Ann. Soc. Linn. Lyon sér. 2, 16: 388 (1868)

  =*Oreoselinum pyrenaeum* Hoffm., Gen. Pl. Umbell.; 155 (1814)

  =*Selinum pyrenaeum* (L.) Gouan, Obs. Bot.: 11 (1773)

- ***Angelica razulii*** **Gouan, Ill. Observ. Bot.: 13. t. 6. (1773)**

  =*Angelica diversicolor* Dulac, Fl. Hautes-Pyrénées: 345 (1867)

  =*Angelica ebulifolia* Lapeyr., Suppl. Hist. Pl. Pyrénées 1: 156 (1818)

  =*Angelica flavescens* Besser, Prim. Fl. Galic. 1: 213 (1809)

  =*Angelica montana* Schleicher in Sprengel, Pl. Umb. Prodr.: 16 (1813)

  =*Angelica tournefortiana* Cusson ex Steud., Nomencl. Bot. [Steudel] 50 (1821)

  =*Imperatoria razoulii* Hort.Vindob. ex Schult., Syst. Veg., ed. 15 bis [Roemer & Schultes] 6: 602 (1820)

  =*Selinum razulii* (Gouan) Link, Enum. Hort. Berol. Alt. 1: 269 (1821)

- ***Angelica sylvestris* L., Sp. Pl.: 251 (1753)**

≡ *Imperatoria sylvestris* Lam., Fl. Franç. (Lamarck) 3: 417 (1779)

=*Angelica apiifolia* Sennen, Bull. Soc. Bot. France 63: 127 (1916)

=*Angelica heterocarpa* J.Lloyd, Bull. Soc. Bot. France 6: 709 (1860)

=*Angelica macrophylla* Schur, Enum. Pl. Transs.: 262 (1866)

=*Angelica montana* Brot., Fl. Lusit. 1: 426 (1804)

=*Angelica montana* Gaudin, Fl. Helv. 2: 341 (1828)

=*Angelica nemorosa* Ten., Fl. Neapol. Syll.: t. 231, 561 (1831)

=*Angelica pratensis* J. Presl «fe K. Presl, Fl., Cech. 61 (1819)

=*Angelica sylvestris* ssp. *bernardiae* Reduron, Ombellif. France 1: 340-343, fig. 41 (2007)

=*Peucedanum angelica* Caruel in Parí., Fl. Ital. 8: 28 (1888)

=*Selinum angelica* Roth, Tent. Fl. Germ. 1: 133 (1788)

=*Selinum sylvestre* Crantz, Stirp. Austr. Fase. 1: 177 (1762)

- ***Angelica sylvestris* L. ssp. *villosa* (Lag.) González-Toral, Nava, Cires & Fern.Prieto comb. nov.**

≡*Angelica villosa* Lag., Gen. Sp. Nov.: 12 (1816)

- ***Angelica sylvestris* L. ssp. elatior (Wahlenb.) González-Toral, Nava, Cires & Fern.Prieto comb. nov.**

≡Angelica sylvestris L. var. eliator Wahlenb. Fl. Caarpat.: 84 (1814)

- ***Angelica sylvestris* L. ssp. *elatior* f. *heterocarpa* (J.Lloyd) González-Toral, Nava, Cires & Fern.Prieto comb. nov.**

  ≡*Angelica heterocarpa* J.Lloyd, Bull. Soc. Bot. France 6: 709 (1860)

- ***Ostericum palustre* (Besser) Besser, Enum. Pl. [Besser]: 94 (1822)**

  ≡*Imperatoria palustris* Besser, Prim. Fl. Galiciae Austriac. 1: 214 (1809)

  =*Angelica palustris* Hoffm., Gen. Pl. Umbell. 162 (1814)

  =*Angelica pratensis* M.Bieb. ex Fisch., Cat. Jard. Pl. Gorenki (1812), nom. inval.

  =*Ostericum pratense* Hoffm., Gen. Pl. Umbell., ed. 2. 164 (1816)

  =*Selinum ostericum* E.H.L.Krause, Deutschl. Fl. (Sturm), ed. 2., 12: 119 (1904)

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Data availability statement

The data that support the findings of this study are openly available in Genbank at https://www.ncbi.nlm.nih.gov/genbank/. The reference number of each sequence are specified in Table 3.

Disclosure statement

The authors declare no conflict of interest.

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APPENDIX 1

List of Apioidae taxa used in the ITS phylogenetic analysis. The associated data have been gathered from previous studies. The order of the displayed data correspomnds to the following information: taxon name, collection site, collector, voucher and GenBank accession numbers.

Acronema atrantiifolium H. Wolff, Shudu Lake (Yunnan, China), voucher KUN:J03 ZJ0526: EU236155; ***Acronema paniculatum*** (Franch.) H. Wolff, Ma'er Mt., Heqing, (Yunnan, China)**,** voucher KUN:J030 :FJ385031; ***Acronema schneideri*** H. Wolff, Shangri-La, Tiansheng Bridge, (Yunnan, China)**,** voucher ZJ810826 (KUN):EU236156; ***Aethusa cynapium*** L.**,** Cultivated in Jardin Botanique de Caen, no. 1424 (France), Downie, voucher Downie 337 (ILL): AH003541 (=U30582 and U30583)*;* ***Aethusa cynapium*** L., Cultivated in Jardin Botanique de Caen, no. 1424 (France), Downie, voucher Downie 337 (ILL): GQ862376; ***Aletes acaulis*** (Torr.) J.M.Coult. & Rose, Canyon of the Big Thompson, Larimer Co. (Colorado, U.S.A.), Hartman, voucher Hartman 24386 (RM)*:* AF358528 and AF358461. ***Aletes acaulis*** (Torr.) J. M. Coult. & Rose, Boulder Co. (Colorado, U. S. A.), T. Hogan, voucher T. Hogan 1739 (RM 577080): KF619603; ***Ammi majus*** L., Sevilla, Andalucía (Spain), P. Jiménez-Mejías, voucher P. Jiménez-Mejías 54PJM06, UPOS: KJ473864; ***Ammi majus*** L., Cervognano-Montepulciano, province of Siena, Tuscany (Italy), voucher WU:W. & S.Till s.n.: MT513148; ***Anethum graveolens*** L., Cultivated in Jardin Botanique de Caen (no. 1980) (France), Downie, voucher Downie 326 (ILL): AH003470 (=U30550 and U30551); ***Anethum graveolens*** L., voucher MP 519:MN257763; ***Angelica acutiloba*** (Siebold & Zucc.) Kitag: AB569093; ***Angelica ampla*** A. Nelson, Flat Tops-White River Plateau, Garfield Co. (Colorado, U.S.A.), voucher Hartman 25821 (RM): AH006065 (=U79597 and U79598). ***Angelica ampla*** A. Nelson, Medicine Bow Mts., Carbon Co. (Wyoming, U.S.A.), voucher Nelson 74945 (RM 915607): MT735408. ***Angelica ampla*** A. Nelson, Laramie, Albany Co. (Wyoming, U.S.A.), voucher Lukas 8251 (RM 915615): MT735409. ***Angelica amurensis*** Schischk., Dailing, Liangshui Nature Reserve (Helongjiang, China), voucher Liao & Zhang 2016082806 (SZ): MT735424; ***Angelica amurensis*** Schischk., voucher NHW 200404: DQ263581; ***Angelica anomala*** Avé-Lall., GAP depot, Chuanshan County (GAP) (China), voucher CDCM:20100613: HQ699461; ***Angelica anomala*** Avé-Lall., voucher NHW 200403: DQ263582; ***Angelica apaensis*** R.H. Shan & C.Q. Yuan, voucher its-yy1: EU001364; ***Angelica archangelica*** L., Findland from material cultivated in University of Joensuu Botanical garden, Joensuu (North Karelia, Finland), Downie, voucher Downie 79 (ILL) (nº 33): AH003539 (=U30576 and U30577); ***Angelica archangelica*** L., Kanas, Xinjiang (China), Wang, voucher Wang CB 727249 (SZ); GU395171; ***Angelica archangelica*** L., cultated in cultivated in University of Illinois Urbana-Champaign (UIUC) (U. S. A) from Matrial of University of Joensuu Botanical Garden (Finland), Downie, voucher Downie 79 (ILL): MT735410. ***Angelica archangelica*** L., cultivated in University of Illinois Urbana-Champaign (UIUC) (U. S. A) from material of University of Botanical Garden (Finland), Downie, voucher Downie 79 (ILL): MT735410. ***Angelica archangelica*** L., cultivated in cultivated in University of Illinois Urbana-Champaign (UIUC) (U. S. A) from material of University of Turku (Finland), Downie Downie 419 (ILL): MT735411. ***Angelica archangelica*** L., cultivated in University of Illinois Urbana-Champaign (UIUC) (U. S. A) from material of University of Kuopio (Finland), Downie, voucher Downie 435 (ILL): MT735412. ***Angelica archangelica*** L., cultivated in

cultivated in the University of California Botanical Garden (UC Botanical Garden), Berkeley (California, U.S.A) from material of Moscow (Russia), voucher C-1693 (ISU 13350): MT735413; ***Angelica arguta*** Nutt. ex Torr. & A. Gray: AH006066; ***Angelica atropurpurea*** L., White Pine State Park, Ogle Co. (Illinois, U.S.A), Phillippe, Phillippe et al. 40690 (ILLS 242713): MT735421; ***Angelica atropurpurea*** L., Kinney's Ford Seep., Vermilion Co. (Illinois, U.S.A), Phillippe, voucher Phillippe 18763 (ILLS 176702.1): MT735422; ***Angelica balangshanensis*** R.H. Shan & F.T. Pu, Sichuan (China), Liao CY, voucher 742598 (SZ): HQ896671***; Angelica biserrata*** R.H.Shan & C.Q.Yuan, Anhui (China), Liao CY, voucher 666796 (SZ): GU395180; ***Angelica biserrata*** R.H.Shan & C.Q.Yuan, Tianmu Mountain, Linan Co. (Zhejiang, China), Liao CY et al., Liao et al. 2014111001 (SZ): MT735572; ***Angelica brevicaulis*** B. Fedtsch., Houxia, Xinjiang (China), Wang, voucher Wang CB 727248 (SZ): GU395170; ***Angelica brevicaulis*** B. Fedtsch., Taragay River (Issyk-Kul Region, Kyrgyzstan) Phillippe, voucher Phillippe et al. 30918 (ILLS 204789): MT735423; ***Angelica brevicaulis*** B. Fedtsch., Tianshan, Fukang Co., (Xinjiang, China), Bartholomew, Bartholomew et al. 8540 (MO 5724329): MT735417; ***Angelica brevicaulis*** B. Fedtsch., voucher SZ727248: GU395170; ***Angelica breweri*** A. Gray, Diamond Mtn., Lassen Co., (California, U.S.A), Ertter, voucher Ertter 7869 (RM 567616): MT735440; ***Angelica breweri*** A. Gray, Bucks Lake, Plumas Co., (California, U.S.A), Taylor and Foster, voucher Taylor & Foster 3896 (MO 3209901): MT735441; ***Angelica californica*** Jeps., Natalie Coffin Greene Park, Marin Co. (California, U.S.A), Smith and Follette, voucher Smith & Follette s.n. (CAS 1115946): MT735508; ***Angelica californica*** Jeps., Lucas Valley road, Marin Co. (California, U.S.A), Smith, voucher Smith s.n. (CAS 1202614): MT735509; ***Angelica callii*** Mathias & Constance, Greenhorn Mtn, Kern Co., (California, U.S.A), Shevock, voucher Shevock 10775 (CAS 1170580): MT735531; ***Angelica callii*** Mathias & Constance, Mill Creek, Sequoia National Forest, Fresno Co. (California, U.S.A), York and Tenneboe, York & Tenneboe 2329 (CAS 1118158): MT735532; ***Angelica canbyi*** J.M. Coult. & Rose, Wenatchee, Chelan Co. (Washington, U.S.A), Whited, voucher Whited 1410 (OSC 7586): MT735547; ***Angelica canbyi*** J.M. Coult. & Rose, Bingham Springs, Western Blue Mtn, Umatilla Co. (Oregon, U.S.A), Cusick, Cusick 3288a (OSC 634459: MT735548; ***Angelica capitellata*** (A. Gray) Spalik, Reduron & S. R. Downie, voucher DM12_719 18S: KF619735; ***Angelica capitellata*** (A. Gray) Spalik, Reduron & S. R. Downie, Anderson Creek and Wood River, Blaine Co., (Idaho, U.S.A) Warnock & Sterner, voucher Warnock & Sterner 1970 (ILL): MT735497; ***Angelica capitellata*** (A. Gray) Spalik, Reduron & S. R. Downie, Grizzly Valley Quad., Plumas Co. (California, U.S.A), Taylor, voucher Taylor 4120 (MO 4016388): MT735496; ***Angelica cartilaginomarginata.***var***.foliosa*** C.Q. Yuan & R.H. Shan**,** Jiangsu (China), Liao CY, voucher 667428 (SZ): GU395177**;** ***Angelica cartilaginomarginata*** (Makino ex Y. Yabe) Nakai, Tonghua (Jilin, China), Huasheng Peng, voucher Huasheng Peng 055-02: JX022901; ***Angelica cartilaginomarginata*** var. ***matsumurae*** (H. Boissieu) Kitag., Muyuzi, Huanren Co. (Liaoning, China), Liao, Liao et al. 2015072809 (SZ) MT735573; ***Angelica cincta*** H. Boissieu, cultivated in Moscow State University Botanical Garden (Russia), Katz-Downie, voucher Katz-Downie et al., 1999: AF008601 and AF009080; ***Angelica cincta*** H. Boissieu, East of Vityaz, Gamov Peninsula, Khasansky District (Primosrky Krai, Russia), Solomon and Barkalov, voucher Solomon & Barkalov 19580 (MO 4629223): MT735425; ***Angelica czernaevia*** (Fisch. & C.A. Mey.) Kitag., Dailing suburb (Helongjiang, China), Liao, Liao et al. 2016082802 (SZ): MT735553; ***Angelica czernaevia*** (Fisch. & C.A. Mey.)

Kitag., Muyuzi, Huanren Co. (Liaoning, China), Liao, Liao et al. 2015072813 (SZ): MT735554; ***Angelica dabashanensis*** C.Y. Liao & X.J. He, voucher SZ666959: HQ896670; ***Angelica dahurica*** (Hoffm.) Benth. & Hook.f. ex Franch. & Sav.: AB569095; ***Angelica dahurica*** (Hoffm.) Benth. & Hook.f. ex Franch. & Sav., China, cultivated in the University of California Botanical Garden (UC Botanical Garden), Berkeley (California, U.S.A), voucher No. 88.0678: MT735565; ***Angelica dawsonii*** S. Watson, North West of Hoodoo Pass, Lolo National Forest, Mineral Co. (Montana, U.S.A.), Stickney, voucher Stickney 1875 (RM 404596): MT735551; ***Angelica dawsonii*** S. Watson, East of Hamilton, Skalkaho Pass Road, Ravalli Co. (Montana, U.S.A.), Hitchcock, voucher Hitchcock 23956 (RM 277277): MT735552; ***Angelica decurrens*** B. Fedtsch,, voucher KUN:ZJ0738: FJ385033; ***Angelica decurrens*** B. Fedtsch, voucher SZ727249: GU395171; ***Angelica decurrens*** B. Fedtsch, Irkutsk Region (Siberia, Russia) cultivated in Moscow State Univ. Botanical Garden (Russia), Pimenov, voucher Pimenov et al. s.n. (MW): MT735414; ***Angelica decurrens*** B. Fedtsch, Altay (Xinjiang, China), Li, voucher Li et al. 20160716 -04 (SZ): MT735415; ***Angelica decurrens*** B. Fedtsch, Fuyun Co. (Xinjiang, China), Li, voucher Li et al. 20160718-04 (SZ): MT735416, ***Angelica decursiva*** (Miq.) Franch. & Sav.: AJ131293; ***Angelica decursiva*** (Miq.) Franch. & Sav., Siming Mtn., Yuyao City, (Zhejiang, China), Liao, voucher Liao et al. ZHQH2014 (SZ): MT735549; ***Angelica dentata*** (Chapm. ex Torr. & A. Gray) J.M. Coult. & Rose, Wakulla Co.- León Co. (Florida, U.S.A.), Kral, voucher Kral 64448 (MO 5990771): MT735519; ***Angelica dentata*** (Chapm. ex Torr. & A. Gray) J.M. Coult. & Rose, Wright Lake, León Co. (Florida, U.S.A.), Kral, voucher Kral 52412 (MO 4271710): MT735520; ***Angelica dielsii*** H. Boissieu, Daba Mtns (Shaanxi, China), Liao CY, voucher 666961 (SZ): GU395154; ***Angelica duclouxii*** Fedde ex H. Wolff, Dongchuan (Yunnan, China), Liao CY, voucher 674189 (SZ): GU395155; ***Angelica edulis*** Miyabe ex Y. Yabe, Tohoku Univerty Experimental Forest (Miyagi Pref., Japan) Kuriyama, voucher Kuriyama s.n. (MO 4365802): MT735463; ***Angelica fargesii*** H. Boissieu, Daba Mtns. (Shaanxi, China), Liao CY, voucher 673574 (SZ): GU395181; ***Angelica furcijuga*** Kitag.: DQ278164; ***Angelica genuflexa*** Nutt. ex Torr. & A. Gray: DQ263566; ***Angelica genuflexa*** Nutt., Haines airport, Skagway Quad. (Alaska, U.S.A.), Parker, voucher Parker et al. 9882 (ALA V130563) MT735469; ***Angelica genuflexa*** Nutt., Hanna Lake, Malaspina Coastal Plain, Bering Glacier Quad. (Alaska, U.S.A.), Barker and Pratt, voucher Barker & Pratt s.n. (ALA V136716): MT735470; ***Angelica gigas*** Nakai, cultivated in Missouri Botanical Garden Saint Louis City (Missouri, U.S.A.), Klinger and Lievens, voucher Klinger & Lievens 279 (MO 5079406): MT735477; ***Angelica gigas*** Nakai, Jingbai Road, Jingyu Co. (Jili, China), Liao, voucher Liao et al. 2015073002 (SZ): MT735478; ***Angelica gigas*** Nakai: AJ131290; ***Angelica grayi*** J.M. Coult. & Rose, Blair Mountain-North West of Glenwood Springs, Garfield Co. (Colorado, U.S.A.), Vanderhorst and Palaci, voucher Vanderhorst & Palaci 4490 (RM): AY146825 and AY146891; ***Angelica grayi*** J.M. Coult. & Rose, Medicine Bow Mountains Forest Road-West of Centennial, Albany Co. (Wyoming, U.S.A.), Lukas, voucher Lukas 3408 (RM 915628): MT735560; ***Angelica grayi*** J.M. Coult. & Rose, Arapaho National Forest- North of boundary with Pike National Forest, Clear Creek Co. (Colorado, U.S.A.), Nye, voucher Nye et al. 256 (MO 6608950): MT735561; ***Angelica grosseserrata*** Maxim., Shihu, Kuandian Co. (Liaoning, China), Liao, voucher Liao et al. 2015072703 (SZ): MT735398; ***Angelica hakonensis*** Maxim., Fuji Mountain, Shizuoka Pref. (Honshu, Japan), Murata, voucher Murata 37194 (MO 2665957) MT735574; ***Angelica hendersonii*** J.M. Coult. & Rose, Beards Hollow, Pacific Co.

(Washington, U.S.A.), Heckard, voucher Heckard 1648 (ISU 1402): MT735456; ***Angelica hendersonii*** J.M. Coult. & Rose, North of Lucía, Monterey Co. (California, U.S.A.), Constance and Chuang, voucher Constance & Chuang 3771 (ISU 13441): MT735457; ***Angelica heterocarpa*** M.J. Lloyd, cultivated in the Conservatoire Botanique d'Alsace, Mulhouse (Alsace, France) from material of Couëron (Loire-Atlantic, France), Hildenbrand, voucher No. 9508B, Hildenbrand s.n. (ILL) MT735579; ***Angelica heterocarpa*** M.J. Lloyd, cultivated in the Conservatoire Botanique d'Alsace, Mulhouse (Alsace, France) from material of Couëron (Loire-Atlantic, France), Reduron, voucher No. 97.214B, Reduron s.n. Reduron Loriot s.n. (ILL): MT735581; ***Angelica heterocarpa*** M.J. Lloyd, South Atlantic National Botanical Conservatory, Génissac (Gironde, France), Loriot, voucher Loriot s.n. (ILL): MT735581; ***Angelica heterocarpa*** M.J. Lloyd, La Basse-Indre-Indret (Loire-Atlantic, France), Dupont, voucher Dupont et al. s.n. (ILL): MT735582; ***Angelica hirsutiflora*** S.L. Liou, C.Y. Chao & T.I. Chuang, chromosome vouchers cultivated in the University of California Botanical Garden (UC Botanical Garden), Berkeley (California, U.S.A) from material of Shimen, Taipei Co. (Taiwan, China), Chuang, voucher Chuang 3979, C-401 (ISU 1134): MT735570; ***Angelica hirsutiflora*** S.L. Liou, C.Y. Chao & T.I. Chuang, Santiaochiao Lighthouse, Taipei Co. (Taiwan, China), Leong, voucher Leong et al. 2758 (MO 5749038): MT735571; ***Angelica hirsutiflora*** S.L. Liou, C.Y. Chao & T.I. Chuang, Taiwan (China), Yand, voucher Yang TY 0091455 (KUN): HQ256683; ***Angelica japonica*** A.Gray, Osaka University of Pharmaceutucal Sciences, Osaka (Pref. Osaka, Japan): DQ278166; ***Angelica kangdingensis*** R.H.Shan & F.T.Pu ex W.T.Wang, Szechwan Kang ding (China), voucher NHW 200421: DQ263584; ***Angelica keiskei*** Koidz., cultivated in Zhongshan Botanical Garden, Jiangsu (Nanjing, China) form material of Japan, Liao and Tang, voucher Liao & Tang 2015111502 (SZ): MT735563; ***Angelica keiskei*** Koidz., Oshima (Pref. Tokyo, Japan), voucher NHW 200421: DQ263561; ***Angelica kingii*** (S. Watson) J.M. Coult. & Rose, Leidy Creek, White Mountains, Mono Co. (California, U.S.A.), Morefield and McCarty, voucher Morefield & McCarty 4151 (dupl. m) (RM 551984): MT735503; ***Angelica kingii*** (S. Watson) J.M. Coult. & Rose, East Creek-Forest Service Campground, Schell Creek Range, White Pine Co. (Nevada, U.S.A.) Tiehm 9765 (RM 367590): MT735504; ***Angelica koreana*** Maxim (=*Ostericum grosseserratum*): AF455749; ***Angelica laxifoliata*** Diels, Zheduo Mtns., KangDing, (Sichuan, China), voucher SZ2006071804: EU647210; ***Angelica lineariloba*** A. Gray, White Mountain Ranger District, Inyo National Forest, Mono Co. (California, U.S.A.), Meyer and Townesmith, voucher Meyer & Townesmith 223 (MO 6146685): MT735445; ***Angelica lignescens*** Reduron & Danton, cultivated in the Conservatoire Botanique d'Alsace, Mulhouse (Alsace, France) from material of Falial (Azores, Portugal), voucher no. 01037, 2 August 2001, Hildenbrand, Meyer & Reduron s.n.: AY179030; ***Angelica lignescens*** Reduron & Danton, Terceira (Azores, Portugal), H. Schaefer and M. Carine, voucher H. Schaefer & M. Carine T2 (BM): HQ202018; ***Angelica lignescens*** Reduron & Danton, Pico(Azores, Portugal), M. Carine, voucher M. Carine et al. 107 (BM, AZB): HQ202022, ***Angelica lignescens*** Reduron & Danton, Flores (Azores, Portugal), H. Schaefer, voucher H. Schaefer 2008/437 (BM): HQ202034; ***Angelica lignescens*** Reduron & Danton, Flores (Azores, Portugal), H. Schaefer, voucher H. Schaefer 2008/437 (BM): HQ202035; ***Angelica lignescens*** Reduron & Danton Portugal, Azores, Island of Faial (Azores, Portugal), Danton and Reduron, voucher Danton & Reduron 01037 (ILL): MT735498; ***Angelica likiangensis*** H. Wolff , Lijiang (Yunnan, China), Minhui Li, voucher Minhui Li 049-01 HLQA10049-01(KUN): JX022921; ***Angelica longicaudata*** C.Q.

Yuan & R.H. Shan (), Emei Mtn. (Sichuan, China), Liao, voucher Liao CY 673421 (SZ): GU395160; ***Angelica longipes*** H. Wolff, China, Tibet, Nielamu (Tibet, China), Yu, voucher Yu Y 802447 (SZ): HQ256679; ***Angelica lucida*** L, Carter Bay, Kuskokwim Bay, Goodnews Bay Quad. (Alaska, U.S.A.), Parker, voucher Parker 15706 (ALA 150217): MT735489; ***Angelica lucida*** L, Petit Manan Point, Washington Co. (maine, U.S.A.), Hill and Renda, voucher Hill & Renda 30467 (MO 4925887) MT735490; ***Angelica maowenensis*** C.Q. Yuan & R.H. Shan, Szechwan Xiao jin (China), voucher NHW 200413: DQ263585; ***Angelica megaphylla*** Diels, Chongqing Jin fu san (China), voucher NHW 200304: DQ263568; ***Angelica morii*** Hayata, Fujian Wu yi san (China): DQ263573; ***Angelica morrisonicola*** Hayata, Jade Mountain (Taiwan, China), Li, voucher Li et al. 2014080302 (SZ): MT735517; ***Angelica muliensis*** C.Y. Liao & X.G. Ma, China, Sichuan, Muli Co. Ma et al. 2010092905 (SZ): MT735567; ***Angelica nelsonii*** J.M. Coult. & Rose, cultivated in the University of California Botanical Garden (UC Botanical Garden), Berkeley (California, U.S.A) from material of Paraje Matsab., Tenejapa (Chiapas, Mexico), Breedlove, voucher Breedlove 15173, chromosome voucher Berkeley. C-175 (ISU 1132): MT735499; ***Angelica nelsonii*** J.M. Coult. & Rose, Chenpil, Oxchuc (Chiapas, Mexico), Gómez Santiz., voucher Gómez Santiz 274 (MO 4268951): MT735500; ***Angelica nitida*** H. Wolff, Qinghai (China), voucher ZLX 483: DQ263592; ***Angelica omeiensis*** : Szechwan E Mei (China): DQ263571; ***Angelica oncosepala*** Handel-Mazzetti, voucher SZ 2006071803: EU418382; ***Angelica pachycarpa*** Lange, in the Conservatoire Botanique d'Alsace, Mulhouse (Alsace, France) from material of Couëron (Loire-Atlantic, France), Hildenbrand, voucher No. 2009 Hildenbrand s.n. (ILL): MT735505; ***Angelica pachycarpa*** Lange, cultivated in the University of California Botanical Garden (UC Botanical Garden), Berkeley (California, U.S.A) from material cultivated in Riccarton (Christchurch, New Zealand), Healy voucher Healy 143831, Chromosome Vouchers C-567, 596 (ISU 1129): MT735506; ***Angelica palustris*** Hoffm. (=***Ostericum palustre***), Olomouc (Moravia, Czech Republic), Otruba, voucher Otruba 447 (MO 2497627): MT735404; ***Angelica palustris*** Hoffm. (=***Ostericum palustre***), Tartu near the Emajõgi River (Estonia), Skvortsov, voucher Skvortsov et al. s.n. (MO 4252778): MT735405; ***Angelica paeoniifolia*** R.H. Shan & C.Q. Yuan, Lingzhi (Tibet, China), voucher MNH 2008072404: FJ237533; ***Angelica pinnata*** S. Watson, Commissary Ridge, Lincoln Co. (Wyoming, U.S.A.), Hartman, voucher Hartman 41500 (RM):AF358465 and AF358532; ***Angelica pinnata*** S. Watson, Beartooth Mtns., Shoshone National Forest, Park Co. (Wyoming, U.S.A.), Elliott and Kuhn, voucher Elliott & Kuhn 7239 (RM 860686): MT735515; ***Angelica pinnata*** S. Watson, Douglas Creek Trail, Platte River Wilderness, Medicine Bow Mtns., Albany Co. (Wyoming, U.S.A.), Lukas, voucher Lukas 3890 (RM 915622): MT735516; ***Angelica pinnatiloba*** R.H. Shan & F.T. Pu, Huanglong, Songpan Co. (Sichuan, China), Liao, voucher Liao 2019081909 (SZ): MT735568; ***Angelica polymorpha*** Maxim., Gwangdeog-san (Korea), BY Lee, BYLee 090823-13 (KB): JN603223; ***Angelica polymorpha*** Maxim., cultivated in the University of California Botanical Garden (UC Botanical Garden), Berkeley (California, U.S.A) from material of Kyushu (Pref. Miyazaki, Japan), McNamara, voucher McNamara et al. 264 (UC) No. 90.0662: MT735473; ***Angelica polymorpha*** Maxim., China, Liaoning, Huanren Co., Huangai Road, Huanren Co. (Liaoning, China), Liao, voucher Liao et al. 2015072803 (SZ): MT735474; ***Angelica pseudoselinum*** H. Boissieu China, Sichuan, Ma'erkang (Sichuan, China), Mozi ditch, voucher ZJ0629 (KUN): EU236158; ***Angelica pseudoselinum*** H. Boissieu, Wuxi Co., Hongchiba, (Chongqing, China),

Liao, Liao 2019091903 (SZ): MT735569; ***Angelica pubescens*** Maxim., Hakitani (Pref. Osaka, Japan), voucher NHW 200431: DQ263567; ***Angelica pubescens*** Maxim.,. Nagase, Shikoku, (Pref. Kochi, Japan), Yamaoka, voucher Yamaoka et al. FOK-059077 (MO 5960420): MT735475; ***Angelica purpureifolia*** (nom. illeg.), AY548229; ***Angelica razulii*** Gouan ex Avé-Lall., Llaurenti massif, (Aude, France) Reduron, voucher Reduron s.n. (ILL): MT735491; ***Angelica roseana*** L.F. Hend., Blue Miner Lake, Teton Co. (Wyoming, U.S.A.), Hartman, voucher Hartman 50090 (RM): AF358466 and AF358533; ***Angelica roseana*** L.F. Hend., Trout Creek-Cookstove Basin, Big Horn Mtns., Big Horn Co. (Wyoming, U.S.A.), Nelson, voucher Nelson 4583 (RM 347468): MT735536; ***Angelica roseana*** L.F. Hend., Rendevous Mtn., Teton Range, Bridger-Teton National Forest, Teton Co. (Wyoming, U.S.A.), Hartman and Scott, voucher Hartman & Scott 86481 (RM 837529): MT735537; ***Angelica sachalinensis*** Maxim., Hamatonbetsu (Pref. Hokkaido, Japan), voucher NHW 200428: DQ263564; ***Angelica sachalinensis*** Maxim., cultivated in Moscow State University Botanical Garden, Moscow (Russia) from material of Sakhalin Oblast, Sakhalin Island, Chekhov Mtn., Sakhalin Island (Sakhalin Oblast, Russia), Pimenov and Kljuykov, voucher Pimenov & Kljuykov s.n. (MW): MT735427; ***Angelica sachalinensis*** Maxim., Kuki, Honshu (Wakayama Pref., Japan), Mimoro, voucher Mimoro et al. 4161 (MO 2687393): MT735428; ***Angelica shikokiana*** Makino ex Y. Yabe, : AB697610; ***Angelica sinensis*** (Oliv.) Diels: AF393784; ***Angelica songpanensis*** R.H. Shan & F.T., Pu, Songpan (Sichuan, China), voucher Ma XG 714746 (SZ): GU395167; ***Angelica stenoloba*** Kitag., Bozuyama (Hokkaido Pref., Japan), Tsugaru, voucher Tsugaru 5086 (MO 3009426): MT735471; ***Angelica sylvestris*** L.: HQ2566681; ***Angelica sylvestris*** L., Bavarian Swabia (Germany), German-Chinese Exped., voucher German-Chinese Exped. 0562104 (KUN): HQ256681; ***Angelica sylvestris*** L., voucher Peu53: KP682411; ***Angelica sylvestris*** L., cultivated in University of Illinois Urbana-Champaign (UIUC) (U. S. A) from material of University of Turku Botanic Garden, Turku (Finland), Downie, voucher Downie 428 (ILL): MT735575; ***Angelica sylvestris*** L., cultivated in Moscow State University Botanical Garden, Moscow (Russia) from material of Oka Valley (Moscow, Russia), Ostroumova, voucher Ostroumova et al. 1463 (MW): MT735576; ***Angelica sylvestris*** L., NE of Canton Neuchatel (Switzerland), Kohler, voucher Kohler s.n. (MO 6271139): MT735583; ***Angelica sylvestris*** L., Stokksnes (Iceland) Balogh, voucher Balogh 64 (ILL): MT735577; ***Angelica sylvestris*** L., cultivated in University of Illinois Urbana-Champaign (UIUC) (U. S. A) from material of Krosno (Poland), Liao, voucher NPGS (PI 654393) Liao 2018022601 (SZ): MT735578; ***Angelica taiwaniana*** S.S. Ying 1496 China, cultivated in University of Illinois Urbana-Champaign (UIUC) (U. S. A) from material of Shanghai Botanical Garden (China), Downie, voucher Downie 1496 (ILL): MT735566; ***Angelica tarokoensis*** Hayata, Shakatang Forest- Chingshuishan Mtn., Hsiulin Hsiang, Hualian Co. (Taiwan, China), Huang, voucher Huang et al. 586 (MO 5765518): MT735564; ***Angelica tianmuensis*** Z.H. Pan & T.D. Zhuang, Tianmu Mtn. (Zhejiang, China), Liao CY, voucher Liao CY 667442 (SZ): GU395178; ***Angelica tianmuensis*** Z.H. Pan & T.D. Zhuang, Tianmu Mtn., Linan Co. (Zhejiang, China), Liao, voucher Liao et al. 2014111002 (SZ): MT735562; ***Angelica tomentosa*** S. Watson, Forest Ranch Fire Control Station, Paradise Quad., Butte Co. (California, U.S.A.), Taylor, voucher Taylor 3335 (MO 4014289): MT735453; ***Angelica tomentosa*** S. Watson, Big Bend Post Office, Shasta Co. (California, U.S.A), Bacigalupi and Heckard, voucher Bacigalupi & Heckard 6057 (ILL): MT735447; ***Angelica triquinata*** Michx., Mount Mitchell State Park, Yancey Co. (North Carolina,

U.S.A.), Schwarzkopf, voucher Schwarzkopf 0084 (MO 2474283): MT735461; ***Angelica triquinata*** Michx., Franklin-Reddish Knob Mtn., Pendleton Co. (West Virginia, U.S.A.), Boufford, voucher Boufford et al. 21358 (MO 3026411): MT735462; ***Angelica tschimganica*** V.N. Tikhom., Tashkent, (Ahangaran District, Uzbekistan), Tojiboev and Mamarahimov, voucher Tojiboev & Mamarahimov UPL00087 (ILLS 240857): MT735418; ***Angelica tsinlingensis*** K.T. Fu, Shanxi Hua san (China): DQ263572; ***Angelica ursina*** Maxim., Hamatonbetsu (Pref. Hokkaido, Japan), voucher NHW 200429: DQ263565; ***Angelica ursina*** Maxim., Utka River (Kamchatka, Russia), Eriksen and Töpel, voucher Eriksen & Töpel 1416B (ALA V161632): MT735476; ***Angelica valida*** Diels, Chongqing Jin fu san (China), voucher NHW 200306: DQ263569; ***Angelica venenosa*** (J. Greenway) Fernald, Little Black Slough, Wildcat Bluff Area, Johnson Co. (Illinois, U.S.A.), Basinger, voucher Basinger 3924 (ILLS 192155): MT735527; ***Angelica venenosa*** (J. Greenway) Fernald, Elizabethtown Ranger District, Shawnee National Forest, Pope Co. (Illinois, U.S.A.), Shimp and Basinger, voucher Shimp & Basinger 1987 (ILLS 270350.1): MT735528; ***Angelica wheeleri*** S. Watson, Right Fork Indian Creek, Uinta National Forest, Utah Co. (Utah, U.S.A.), Hannan and Leinbach, voucher Hannan & Leinbach s.n. (BRY 617170): MT735541; ***Angelica wheeleri*** S. Watson, Oak Basin, Tushar Mtns., Piute Co. (Utah, U.S.A.), Taye, voucher Taye 4230 (BRY 331456): MT735542; ***Angelica yakusimensis*** H. Hara, Yudomari Mtn., Yakushima Island, Kyushu, (Kagoshima Pref., Japan) Yahara and Akiyama, voucher Yahara & Akiyama 877012 (MO 4381570): MT735472; ***Aphanopleura capillifolia*** Lipsky: DQ516368; ***Aphanopleura trachysperma*** Boiss: Vedi, Ararat (Armenia), V. Manakian, voucher V. MANAKIAN s.n. (MO): AF008629 and AF009108; ***Apium graveolens*** L., Cultivated in Conservatoire et Jardins Botaniques de Nancy (France), Downie, Downie 258 (ILL): AH003471(=U30552 and U30553); ***Apium graveolens*** L., voucher PS0319MT01: MZ191026; ***Arafoe aromatica*** Pimenov & Lavrova, cultivated in Moscow State University Botanical Garden, Moscow (Russia) from material of Lagonaki, Caucasian Reservate, Krasnodar (Russia), voucher Pimenov 403 (MW): U78383 and U78443; ***Arafoe aromatica*** Pimenov & Lavrova: AF077874; ***Arracacia aegopodioides*** J. M. Coult. & Rose, D. Anderson, voucher Anderson 13082 (UC): GQ862378; ***Arracacia nelsonii*** Coult. & Rose, Breed/ove 72434 Mexico, Oaxaca (Mexico), Constance, voucher Constance 2410 (UC): AH003472 (=U30556 and U30557); ***Arracacia xanthorrhiza*** Bancr., Blas, voucher Blas 1 (COL): GQ862445; ***Athamanta macedonica*** (L.) Spreng., Greece, Ioannina, Koukouli, Ioannina (Greece), Dudley, voucher Dudley et al. 18205 (RNG): AF073541; ***Carlesia sinensis*** Dunn (1902), Cultivated in Hort. Nanjing (China), Constance, voucher Constance 2401 (UC): U30563 and U30562; ***Cervaria cervariifolia*** (C.A. Mey.) Pimenov, Iran, Ajani, voucher Ajani 2058 (TUH) (No. 3130): EU169250; ***Chamaele decumbens*** Makino, Ishikawa-gun, Yoshinodani-mura, Yoshino, Ishikawa-ken (Honshu, Japan), Tsugaru, voucher *Tsugaru 14314* (MO): DQ516364; ***Chymsydia colchica*** (Albov) Woronow ex Grossh., Downie, voucher Downie et al. (1998): U78405 and U78465; ***Chymsydia colchica*** (Albov) Woronow ex Grossh.: AF077882; ***Chymsidia colchica*** (Albov) Woronov ex Grossh: HQ256685; ***Cnidiocarpa alaica*** Pimenov, cultivated in Moscow State University Botanical Garden (Moscow, Russia) from material of Kichik-Karamyk (Tadjikistan), M. G. Pimenov, voucher M. G. PIMENOV & al. 1332 (MW): AF008615 and AF009094; ***Cnidium monnieri*** (L.) Cuss., China, Yunnan, Songming (Yunnan, China), voucher ZJ0676 (KUN): EU236164; ***Cnidium monnieri*** (L.) Cuss., Sichuan (China), Liao CY, voucher 802525 (SZ): HQ316168; ***Cnidium monnieri*** (L.) Cuss., voucher SZ802525: HQ256685;

Cnidium monnieri (L.) Cuss., Hebei (China), X.J. Ge,voucher 24-Sep-2013 Ge131194: MH712671; ***Coaxana bambusioides*** Mathias & Constance**,** Breedlove, voucher Breedlove 61980 (CAS): GQ862448; ***Coelopleurum lucidum***, Hokkaido hamatonbetsu (Japan), voucher NHW 200332: DQ270196; ***Coelopleurum saxatile*** Drude, Jilin (China), Liao CY, voucher 706634 (SZ): GU395172; ***Coelopleurum saxatile*** (Tuecz.) Drude, Jiling Chang bai san (China), voucher NHW 200406: DQ270195; ***Cortia depressa*** (D. Don) Leute, cultivated in the Royal Botanic Garden Edinburgh, Edinburgh (Scotland, U.K.), voucher no. 19892739: AF009086 and AF008607; ***Conioselinum tataricum*** Hoffm.: Baidula Gorge, Ottuk, Kirghizia from cultivated in Moscow State University Botanical Garden (Moscow, Russia), M. G. Pimenov, voucherM. G. PIMENOV & al. s.n. (MW): AF008623 and AF009102; ***Conioselinum pacificum*** (Watson) Coult. & Rose, Cape Perpetua, Siuslaw National Forest, Lincoln County (Oregon, U.S.A) Lincoln Co., Applequist and Bradley, voucher Applequist & Bradley 98(MO): MK694936; ***Conioselinum vaginatum*** (Spreng.) Thell., voucher P19(KUN): MG745193; ***Cortiella hookeri*** (C.B.Clarke) C.Norman, Lauribina Yak-Gosainkunda, basin of Trisuli Khola, National Park, Langtang (Central Nepal, East Himalaya), Pimenov and Kljuykov, voucher Pimenov & Kljuykov 51 (MW): AY328932 and AY330498; ***Coulterophytum jaliscense*** McVaugh, Zarzamora (Las Joyas), Sierra de Manantlán, Las Joyas (Jalisco, Mexico) from material cultivated in UC Berkeley, Berkeley (California, U. S. A.), Iltis and L. Constance, voucher Iltis et al. 1299 (UC), L. Constance pers. coll. C-2236: AF358473 and AF358540; ***Coulterophytum laxum*** Robins., Michoacán (Mexico), Iltis, Cochrane and Contance, Iltis 298 & Cochrane (=Contance 2411 (UC): AH003542 (=U30560 and U30561); ***Coulterophytum pubescens*** J.M.Coult.& Rose, Rzedowski, voucher Rzedowski 26206 (MICH): GQ862450; ***Cymopterus glomeratus*** var. ***concinnus*** (Osterh.) Mathias Delta Co. (Colorado, U.S.A.), C. E. Hinchliff, voucher C. E. Hinchliff 1323 (CIC 041348): KF619643; ***Dahliaphyllum almedae*** Constance & Breedlove, Puerto El Gallo-Atoyac (Guerrero, Mexico) from aterial cultivated in Univervisty of California Botanical Garden, Berkeley (California, U. S. A.), L. Constance voucher Breedlove 61970 (UC) L. Constance 2328: U78395 and U78455; ***Deverra aphylla*** DC., Cape (South Africa), S. Castroviejo, voucher S. Castroviejo 14915SC, MA: KJ47387; ***Dichoropetalum schottii*** (Besser ex DC.) Pimenov & Kljuykov (=*Peucedanum schottii* Besser ex DC.), col de Brouis (Alpes-Maritimes, France), Reduron, voucher Herb. Reduron 30 July 1981: AH012695; ***Dimorphosciadium gayoides*** Pimenov: AY328935 and AY330501;***Donnellsmithia juncea*** (Spreng.) Mathias & Constance, Saynes, voucher Saynes 717 (MO): GQ862459; ***Donnellsmithia juncea*** (Spreng.) Mathias & Constance, Paredes, voucher Paredes 10 (MO):GQ862458; ***Dystaenia takesimana***, voucher um13: AY548224; ***Enantiophylla heydeana*** Coult. & Rose, Mantlán (Jalisco, Mexico), Iltis, voucher Iltis et al. 3187: AH003475 (=U30558 and U30559); ***Enantiophylla heydeana*** Coult. & Rose, Flores-Franco, Calzada and Solis, voucher Flores-Franco, Calzada, & Solis 2840 (MO): GQ862468; ***Endressia castellana*** Coincy., from material cultivated in Institute of Botany of the University of Neuchâtel, Neuchâtel (Canton of Neuchâtel, Switzerland), Constance, voucher Constance 2184 (UC): AH003545 (=U30584 and U30585); ***Exoacantha heterophylla*** Labill, South of Mevo-Hamma (Golan, Israel), A. Liston, voucher A. LISTON 535/1: AF008617 and AF009096; ***Ferulopsis hystrix*** (Bunge ex Ledeb.) Pimenov, Russia from material cultivated in Royal Botanic Garden Edinburgh, Edinburgh (Scotland, U. K.), voucher cult. RBGE 19932301A DNA No. 3215: EU169271; ***Foeniculum vulgare*** L. Canakkale (Turkey): AY581806;

Foeniculum vulgare L. voucher nrITS_LH7218_99: MW366656; ***Glehnia littoralis*** F.Schmidt ex Miq.: EU164928; ***Glehnia littoralis*** F.Schmidt ex Miq., South Korea, voucher gl-02: KX757779; ***Glehnia littoralis*** F.Schmidt ex Miq., voucher 71: MK961278; ***Halosciastrum melanotilingia*** (H.Boissieu) Pimenov & V.N.Tikhom.:AY328937 and AY330503; ***Hansenia forbesii*** (H.Boissieu) Pimenov & Kljuykov, voucher QH8: KJ999465; ***Hansenia mongholica*** Turcz., Karakol Lakes (Altai, Russia) from material cultivated in Moscow State University Botanical Garden (Moscow, Russia), M. G. Pimenov, voucher M. G. PIMENOV & al. 18 (MW): AF008643 and AF009122; ***Hansenia weberbaueriana*** (Fedde ex H.Wolff) Pimenov & Kljuykov, voucher PS2005MT16: JQ936558; ***Harbouria trachypleura*** (A. Gray) J.M. Coult. & Rose, Philmont Scout Ranch, Colfax Co. (New Mexico, U.S.A.), Embry, voucher Embry 56 (RM): AF358493 and AF358560; ***Harrysmithia heterophylla*** H. Wolff, GQ379321, China, Sikiang: Kangting (Tachienlu), Smith, voucher *Smith 10804* (MO) (29-VII-1934): GQ379321; ***Heracleum sphondylium*** L., findland, cultivated in University of Koupio Botanical Garder, Downie, voucher Downie 433 (ILL): AH003484 (=U30546 and U30547); ***Heracleum sphondylium*** L., Piwniczna Zdrój, Małopolskie voivodeship (Poland), *Piwczyński,* voucher *Piwczyński KEIB_AP_00052* (cultivated from seeds): MK050079; ***Imperatoria ostruthium*** L.: AF077896; ***Johrenia aromatica*** Rech.f., Ajani, voucher Ajani s.n. (Hb. Akhani): EU169288; ***Kadenia dubia*** (Schkuhr) V.N. Tikhom. & Lavrova, Aktau Mtns. (Dzheskasgan province, Kazakhztan), Pimenov and Kljuykov, voucher Pimenov & Kljuykov 117 (MW): AY328950 and AY330516; ***Karatavia kultiassovii*** (Korovin) Pimenov & Lavrova, cultivated in Moscow State University Botanical Garden (Moscow, Russia) from material of Mynzhilke, Syrdariinsky Karatau Gorge (Kazakhstan), M. G. Pimenov, M. G. PIMENOV & al. 164 (MW): AF008612 and AF009091; ***Komarovia anisosperma*** Korovin: AF077897; ***Komarovia anisosperma*** Korovin, Urgut, Zeravschan Mtns. (Uzbekistan) from material cultivated in Moscow State University Botanical Garden (Moscow, Russia), Pimerov, voucher Pimenov et al. 178 (MW): U78381 and U78441; ***Komarovia anisosperma*** Korovin, voucher 2019-06-23#08: MN832991; ***Ledebouriella multiflora*** H.Wolf :FJ489337 and FJ489368; ***Libanotis eriocarpa*** Schrenk, Tian Mt., Fukang (Xinjiang, China), voucher *ZJ0708* (KUN): FJ385045; ***Libanotis pyrenaica*** Bourg. ex Nyman, Haut-Rhin (France), Osenbach, Reduron, voucher 24 July 2001, Reduron s. n. (ILL): AY179026; ***Libanotis schrenkiana***, voucher SschrA94: MG920273; ***Libanotis seseloides*** (Fisch. & C.A. Mey. Ex Ledeb) Turcz, Dunhua City, Hancongling (Jilin, China), Liao, voucher Liao et al. 2015073006 (SZ): MT707544; ***Libanotis sibirica*** (L.) C.A. Mey., Xinjiang, TieLieKe, Habahe (Xinjiang, China), voucher *ZJ0741* (KUN): FJ385046; ***Ligusticum daucoides***(Franch.) Franch., Bowa Mtn., Daocheng (Sichuan, China), voucher ZJ0556 (KUN): EU236173; ***Ligusticopsis dielsianaei*** (H. Wolff) Pimenov & Kljuykov, Ranwu-Shanranwu (Sichuan, China) Pimenov, voucher Pimenov et al. 416 (MW): AY328945 and AY330511; ***Ligusticum mucronatum*** (Schrenk) Leute, voucher J110 (XAU): FJ385047; ***Ligusticum oliverianum*** (H. de Boissieu) Shan, Geka Country, Daofu (Sichuan, China), voucher KUN *201606127*: MK036610; ***Ligusticum physospermifolium*** Albov, cultivated Moscow State University Botanical Garden (Moscow, Russia) from material of Teberdinsky Reserve (Stavropol Region, Russia), M. G. Pimenov, voucher M. G. PIMENOV & al. s.n. (MW): AF008616 and AF009095; ***Ligusticum pteridophyllum*** Franch. Rewu Country, Xiangcheng (Sichuan, China), voucher KUN *Z15177*: MK036612; ***Ligusticum scapiforme*** H. Wolff, Kalatz Mt., Litang (Sichuan, China), voucher KUN *Z15162*: MK036614; ***Ligusticum scoticum*** L.,

cultivated in University of Illinois at Urbana-Champaign (UIUC) (Illinois, U.S.A.) from material of the Jardin Botanique de Montréal (Quebec, Canada), Downie, voucher Downie 3 (ILL): AH006062 (=U79591 and U79592), ***Ligusticum scoticum*** L., voucher RBGE6: KX167844; ***Ligusticum scoticum*** **subsp.** ***hultenii*** (Fern.) Calder & Taylor, East of Montague Island (Alaska, U.S.A.), *Lewis*, voucher *Lewis ALA V110933*: MK694948; ***Ligusticum sikiangense*** Hiroe, Yanyuan, (Sihuan, China), voucher KUN *20160636*: MK036619; ***Ligusticum physospermifolinum*** Albov, Teberdinsky Reserve (Stavropol Region, Russia) from material cultivated in Moscow State University Botanical Garden (Moscow, Russia), M. G. Pimenov, voucher M. G. PIMENOV & al. s.n. (MW): AF008616 and AF009095; ***Ligusticum thomsonii*** C. B. Clarke, Daofu-Bamei, (Sichuan, China), voucher KUN *201606132*: MK036623; ***Ligusticum weberbauerianum*** H. Wolff, Jianziwan Mt., Yajiang (Sichuan, China), Feiyong and Liliangqian, voucher *Feiyong&Liliangqian2969* (KUN): MK036626; ***Lomatocarpa albomarginata*** (Schrenk) Pimenov & Lavrova, Usunmurun river, Karamyk, Alai Mts. (Kirghyzia), Pimenov and Kljuykov, voucher Pimenov & Kljuykov, 427 (MW): AY328954 and AY330520; ***Lomatium bicolor*** var. ***leptocarpum***, Flattop Butte, Owyhee Co. (Idaho, U.S.A.), voucher CIC:D3434: HQ426089; ***Lomatium brandegeei*** (J. M. Coult. & Rose) J. F. Macbr, Kittitas Co. (Washington, U.S.A.), D. Mansfield, voucher D. Mansfield 11-477, (CIC 041532): KF619632; ***Lomatium californicum*** (Nutt.) Mathias & Constance, Josephine Co. (Oregon, U.S.A.), R. Helliwell, voucher R. Helliwell 3949 (CIC 039924): KF619636; ***Lomatium grayi*** (J. M. Coult. & Rose) J. M. Coult. & Rose, Malheur Co. (Oregon, U.S.A.), E. George, voucher E. George 050 (CIC 039901): KF619669; ***Lomatium grayi*** (J. M. Coult. & Rose) J. M. Coult. & Rose, Yakima Co. (Washington, U.S.A.), C. E. Hinchliff, voucher C. E. Hinchliff 1240 (CIC 041459): KF619670; ***Lomatium foeniculaceum*** (Nutt.) J. M. Coult. & Rose var. ***macdougalii*** (J. M. Coult. & Rose) Cronquist, Canyon Co. (Idaho, U.S.A.), D. Mansfield, voucher D. Mansfield 07-001 (CIC 034364): KF619660; ***Lomatium nevadense*** (S. Watson) J. M. Coult. & Rose, Page Springs Campground, Harney Co. (Oregon, U.S.A.), voucher CIC:0344242': HQ426096; ***Lomatium nevadense*** (S. Watson) J. M. Coult. & Rose **var**. ***parishii*** (J. M. Coult. & Rose) Jeps., Apache Co. (Arizona, U.S.A.), C. E. Hinchliff, voucher C. E. Hinchliff 1283 (CIC 040914): KF619681; ***Lomatium nudicaule*** (Pursh) J. M. Coult. & Rose, Washington Co. (Idaho, U.S.A.), E. George, voucher E. George 065 (CIC 039895): KF619685; ***Lomatium ochocense*** Helliwell & Constance, Crook Co. (Oregon, U.S.A.), R. Helliwell, voucher R. Helliwell 3961 (CIC 044308): KF619688, ***Lomatium pastoralis*** D. H. Wagner ex M. E. Darrach & D. H. Wagner, Umatilla Co. (Oregon, U.S.A.), M. Darrach, voucher M. Darrach 675 (CIC 042000). KF619691; ***Lomatium salmoniflorum*** (J. M. Coult. & Rose) Mathias & Constance, Whitman Co. (Washington, U.S.A.), C. E. Hinchliff, C. E. Hinchliff 1209 (CIC 041450): KF619698; ***Lomatium triternatum*** (Pursh) J. M. Coult. & Rose **var.** ***triternatum***, Río Arriba Co. (New Mexico, U.S.A.), C. E. Hinchliff, voucher C. E. Hinchliff 1280 (CIC 040913): KF619714, ***Lomatium triternatum*** (Pursh) J. M. Coult. & Rose **var.** ***triternatum***, Benton Co. (Washington, U.S.A.), M. Darrach, voucher M. Darrach 630 (CIC 042001): KF619702; ***Lomatium triternatum*** (Pursh) J. M. Coult. & Rose **var.** ***triternatum***, Harney Co. (Oregon, U.S.A.), D. Mansfield, voucher D. Mansfield 11-007 (CIC 040127): KF619715; ***Magadania victoris*** (Schischk.) Pimenov & Lavrova, Russia, Magadan prov., near Magadan (Magadan prov., Russia), H. E. Grosset, voucher H. E. Grosset (MW): AY328947 and AY330513; ***Malabaila aurea*** Boiss., Veles (Macedonia), Mayer, voucher Mayer 50567 (KRAM): EU594919; ***Malabaila aucheri*** Boiss., East of

Bedehan (Iran), Davis and Bokhari, Davis & Bokhari 55816: EU185665; ***Malabaila dasyantha*** (C. Koch) Grossh., Turkey, Menemen and Hamzaoglu, voucher Menemen & Hamzaoglu 60 (ADO) DNA No. 1862: EU169296; ***Malabaila involucrate*** Boiss. & Spruner, Greece, Cghanson, Cghanson *s.n.*: EU185669; ***Malabaila pastinacifolia*** Boiss. & Bal., Turkey, voucher Duran & al. 5498 (ADO) DNA No. 1861: EU169297; ***Mathiasella bupleuroides*** Constance & Hitchcock, Cerro El Viejo, (Nuevo León, Mexico) from material cultivated in University of California Botanical Garden, Berkely (California, U. S. A.), Hinton et al. 22234 (UC), L. Constance, voucher L. Constance 2447: U78394 and U78454; ***Myrrhidendron donnellsmithii*** Coult. & Rose, Province of San José (Costa Rica) from material cultivated int UC Botanical Garden, Berkely (California, U. S. A.), Grantham and Parso, voucher Grantham and Parsons 0433-90 (nº. 90.2637): AH003480 (=U30554 and U30555); ***Myrrhidendron donnellsmithii*** Coult. & Rose, Alfaro, voucher Alfaro 1727 (MO): GQ862471; ***Meeboldia yunnanensis*** (H.Wolff) Constance & F.T.Pu ex S.L.Liou, voucher GB0005MT01: KF725057; ***Meum athamanticum*** Jacq.: AF077900; ***Meum athamanticum*** Jacq., Murias Longas, Somiedo (Asturias, Spain), T. Sánchez Corominas, V.M. Vázquez and J.A. Fernández Prieto, voucher FCO:32709: KC676174; ***Musineon divaricatum*** (Pursh) Nutt. ex Torr. & A. Gray var. ***divaricatum***, north-west of Chugwater Platte Co., NW of Chugwater (Wyoming, U.S.A.), Nelson, voucher Nelson 30905 (RM): AF358506 and AF358573; ***Musineon divaricatum*** (Pursh) Nutt., White Pine Co. (Nevada, U.S.A.), C. E. Hinchliff, voucher C. E. Hinchliff 1311 (CIC 041346): KF619722; ***Musineon divaricatum*** (Pursh) Nutt., Horstmann Peak, Sawtooth Mnts., Sawtooth National Forest (Idaho, U.S.A.), voucher August 7, 2012 Zion 2012-038 ID: MK802451; ***Musineon lineare*** (Rydb.) Mathias, Bear Lake Co. (Idaho, U.S.A.), D. Mansfield, voucher D. Mansfield 12-692: KF619723; ***Musineon vaginatum*** Rydb., Missoula Co. (Montana, U.S.A.), P. Lesica, voucher P. Lesica 10620 (CIC 041462): KF619724; ***Naufraga balearica*** Constance & Cannon, Majorca (Balearic Islands, Spain), P. Vargas, voucher P. Vargas 81PV11, MA Balearic Islands, Majorca: KJ473894; ***Naufraga balearica*** Constance & Cannon, Cala de Sant Vicenc., Port de Pollenca, Majorca (Balearic Islands, Spain) from material cultivated in Royal Botanic Garden Edinburgh, Edinburgh (Scotland, U.K.) McBeath, voucher McBeath 2760 (E) (no. 19943095): AF073563; ***Neoparrya lithophila*** Mathias, Upper Saguache Forest Service Station, Saguache Co. (Colorado, U.S.A., Colorado), Hartman, voucher Hartman 17360 (RM): AF358576 and AF358509; ***Neoparrya lithophila*** Mathias,Taos Co. (New Mexico, U.S.A.), C. E. Hinchliff, voucher C. E. Hinchliff 1275 (CIC 040908): KF619725; ***Notopterygium incisum*** Ting ex H.T. Chang, KIB nursery (Yunnan, China), voucher ZJ0697: EU236180; ***Notopterygium incisum*** Ting ex H.T. Chang, Szechwan Kang ding (China): DQ278168; ***Notopterygium incisum*** Ting ex H.T. Chang, China, voucher Ho et al. 258 23-VII-1993 (MO): GQ379335; ***Oreocomopsis stelliphora*** (Cauwet & Farille) Pimenov & Kljuykov, Farille, voucher Farille 81-421 18-IX-1981 (G): GQ379322; ***Oreonana clementis*** (M.E. Jones) Jeps, Guyot Mtn., Tulare County (California, U.S.A.), Howell, voucher Howell 25604 (UTC): AY146857 and AY146923; ***Oreonana purpurascens*** Shevock & Constance, Slate Mountain, Sequoia National Forest, Tulare Co. (California, U.S.A.), Shevock, voucher 26 Apr 1977 Shevock 5428 (BRY): AY146858 and AY146924; ***Oreonana vestita*** (S. Watson) Jeps., Mt Harwood-Mt San Antonio Peak, San Gabriel Mtns, Angeles National Forest, San Bernardino Co. (California, U.S.A.), Shevock, voucher 4 May 1977 Shevock 5433 (BRY): AY146859 and AY146925; ***Oreoselinum nigrum*** Delarbre (=*Peucedanum oreoselinum* (L.) Moench),

Larzac (Aveyron, France) Aveyron, Chéon, voucher Chéon s. n. (WA): AH012698 (=AF495836 and AF495837); ***Oreoxis alpina*** (A. Gray) J.M. Coult. & Rose subsp. ***alpina***, Pyramid Peak, Río Blanco Co. (Colorado, U.S.A.) Vanderhorst, voucher 27 June 1991 Vanderhorst 2806 (RM): AF358510 and AF358577; ***Oreoxis alpina*** (A. Gray) J.M. Coult. & Rose, Larimer Co. (Colorado, U.S.A.), S. Nunn, voucher S. Nunn 2078 (RM 765899): KF619726; ***Oreoxis bakeri*** J.M. Coult. & Rose, Lake Peak, Santa Fe Co. (New Mexico, U.S.A.) Hartman voucher 19 June 1980 Hartman 11725 (RM): AF358511 and AF358578, ***Oreoxis humilis*** Raf., Pikes Peak Road, Teller Co. (Colorado, U.S.A.), Hartman, voucher Hartman 11718 (RM): AF358579 and AF358512; ***Oreoxis trotteri*** S.L. Welsh & S., North West of Moab, Grand Co. (Utah, U.S.A.), Neese and Welsh, voucher 4 Jun 1985 Neese & Welsh 16984 (BRY): AY146861 and AY146927; ***Ormosolenia alpina*** (Sieber ex Schultes) Pimenov, Mtn. Pachnes, Lefka Ori (Crete, Greece), voucher Pimenov Brullo & Giusso del Galdo 2061 (CAT): HQ269391; ***Orogenia fusiformis*** S. Watson., Jackson Co. (Oregon, U.S.A.) J. T. Duncan, voucher J. T. Duncan 7A (CIC 041668): KF619727; ***Orogenia linearifolia*** S. Watson, Hams Fork Plateau, Lincoln Co. (Wyoming, U.S.A.), Hartman, voucher Hartman 37557 (RM): AF358513 and AF358580; ***Orogenia littariaefolia*** S. Watson, Hornet Cr. - Bear, Adams Co. (Idaho, U.S.A.), voucher CIC:034349: HQ426099; ***Ostericum citriodorum*** (Hance) R.H. Shan & C.Q. Yuan, China, Guangxi, Luzhai (Guangxi, China), Liao CY, voucher Liao CY 908277 (SZ): JX312701; ***Ostericum grosseserratum*** (Maxim.) Kitag., Jinzhai (Anhui, China), Liao CY, voucher Liao CY 667435 (SZ): GU390409; ***Ostericum huadongensis*** Z.H. Pan & X.H. Li, Jinzhai (Anhui, China), Liao CY, Liao CY 667429 (SZ): GU395175; ***Ostericum maximowiczii*** (F. Schmidt) Kitag., China, Jilin, Changbai Mtn. (Jilin, China), Liao CY, voucher Liao CY 744114 (SZ): GU390410; ***Ostericum scaberulum*** (Franch.) R.H. Shan & C.Q., Yuan, China, Yunnan, Shangri-la (Yunnan, China), Liao CY, voucher Liao CY 703013 (SZ): GU390411; ***Ostericum scaberulum*** (Franch.) R.H. Shan & C.Q., Muli County (Sichuan, China) Mianya Liao and Tang, voucher Mianya Liao & Tang 2014101202 (SZ): MT735406; ***Ostericum sieboldii*** (Miq.) Nakai, Changbai Mtn. (Jilin, China), Liao CY, voucher Liao CY 667568 (SZ): GU390412; ***Ostericum sieboldii*** (Miq.) Nakai, Iwaki-shi (Fukushima Prefecture, Honshu, Japan), Yonekura and Ishiguri, voucher Yonekura & Ishiguri 3573 (MO 4987936): MT735403; ***Ostericum viridiflorum*** (Turcz.) Kitag., Yichun (Heilongjiang, China), Wang CB 674185 (SZ): GU390413; ***Ostericum viridiflorum*** (Turcz.) Kitag., Sifongshan, Kiamusze (Helongjiang, China), Liao and Zhang, voucher Liao & Zhang 2016082905 (SZ): MT735402; ***Pachypleurum alpinum*** Ledeb, Mongolia, Caddick, voucher Caddick 172 (E): KJ660840; ***Pachypleurum mutellinoides*** (Crantz) Holub, Col du Gd. St. Bernard, les Alpes Pennines (canton Valais, Suisse), Pimenov, voucher Pimenov et al. S96-13 (MW): AY330506 and AY328940; ***Paraligusticum discolor*** (Ledeb) V.N. Tichom., cultivated in Moscow State University Botanical Garden, (Moscow, Russia) from material of Lepsinsk, Dzhungar Alatau Mtns. (Kazakhstan), Kljuykov, voucher Kljuykov 119 (MW): U78404 and U78464; ***Paraligusticum discolour*** (Ledeb) V.N.Tichom., Lepsinsk, Dzhungar Alatau Mtns. (Kazakhstan) from material Cultivated in Moscow State Univ. Botanical Garden (Moscow, Russia), Kljuykov, voucher Kljuykov 119 (MW): AF077902; ***Parasilaus afghanicus*** (Gilli) Leute, China, Wendelbo, voucher Wendelbo et al. 8509(E): MK088003; ***Parasilaus asiaticus*** (Korovin) Pimenov, Nikolayevsky Spusk (Tadjikistan) from material cultivated in Moscow State University Botanical Garden (Moscow, Russia), M. G. Pimenov, voucher M. G. PIMENOV & al. s.n. (MW): AF008642 and AF009121; ***Pastinaca sativa***

L., material cultivaed in Johannes Gutenberg University, Mainz (Rhineland Palatinate, Germany), Downie, voucher Downie 70 (ILL) (no. 1597): AH003484 (=U30546 and U30547); ***Pastinaca sativa*** L., Musala, Rila Planina (Sofia, Bulgaria), Gardner and Gardner, voucher Gardner & Gardner 3202 (E): EU185666; ***Petroselinum crispum*** (Mill.) Fuss., S. Downie, voucher S. Downie 21 (ILL): GQ148800; ***Petroselinum crispum*** (Mill.) Fuss., voucher PS0325MT01: MZ191031; Peucedanum officinale L., Steinbach (Haut-Rhin, France), Reduron, voucher 5 June 1979, Reduron s. n. (WA): AH012690 (=AF495820 and AF495821); Peucedanum officinale L., voucher C:Simonsen 2013-4: KF160673, Peucedanum officinale L., voucher Peu10: KP682404; ***Phlojodicarpus popovii*** Sipliv., from material cultivated in the Royal Botanic Garden of Edinburgh (Edinburgh, U. K.) voucher (no. 19932315): AF009083 and AF008604; ***Physospermopsis delavayi*** H.Wolff, YuLong Snow Mtn. (Yunnan, China), voucher KUN:J033: FJ385056; ***Physospermopsis delavayi*** (Franch.) H. Wolff, Yulongxue Shan Mtns., Lijiang County (Yunnan, China), Pimenov, voucher Pimenov et al. 532 (MW): FJ625831 and FJ483501; ***Pimpinella afinis*** Ledeb, Mesudiye, Ordu (Turkey), voucher June 2001 ESSE 13890: AY581780; ***Pimpinella austriaca*** Mill.: KX982512; ***Pimpinella brachycarpa*** Nakai: AY548230, ***Pimpinella major,*** Santiago de Arenas, Siero, (Asturias, Spain), Herminio S. Nava, voucher FCO 37750-37751-37752: MH377862; ***Pimpinella lutea*** Desf., cultivated in the Conservatoire Botanique d'Alsace, Mulhouse (Alsace, France) from material of Corsica (France), Hildenbrand, voucher Hildenbrand/C.B.M. 9564 (ILL): DQ516374; ***Pimpinella niitakayamensis*** Hayata, Tunyuan-Yunhai, Jenai Hsiang, Nantou Hsien (Taiwan, China), Chi-Chen Liao, voucher Chi-Chen Liao et al. 1276 (MO): DQ516375; ***Pimpinella olivieroides*** Boiss. & Hausskn., Beynam woods (Ankara, Turkey), voucher June 2000 ESSE 13928: AY581795 ***Pimpinella peucedanifolia*** Fischer, Solhan (Mus, Turkey), voucher July 2001 ESSE 13913: AY581798; ***Pimpinella puberula*** (DC.) Boiss., Hakkari-Van road (Hakkari, Turkey), voucher July 2001 ESSE 13909: AY581799; ***Pimpinella rhodantha*** Boiss., Turkey: Giresun: Tamdere (Giresun, Turkey), August 2001 ESSE 13932: AY581800; ***Pimpinella saxifraga*** L., Sarikamis (Kars, Turkey), July 2001 ESSE 13924: AY581801; ***Pimpinella saxifraga*** L., cultivate in University of Oldenburg Botanic Garden, Oldenburg (Bayern, Germany) Downie, voucher (no. 19) Downie 137 (ILL): AH003548; ***Pimpinella tibetanica*** H.Wolff, voucher G2010070709: JF831528; ***Pimpinella smithii*** H.Wolf, Wolong, Wenchuan (Sichuan, China), voucher ZJ0643: EU236196; ***Pimpinella smithii*** H. Wolff, voucher wzx09092212: JF831526; ***Pimpinella smithii*** H. Wolff, China, Smith, voucher Smith 6931 20-VIII-1924 (MO): GQ379272; ***Pimpinella valleculosa*** K.T.Fu, voucher wzx2010101002: JF831529; ***Pimpinella sintenisii*** Wolff, Turkey: Mardin: Zafran (Mardin, Turkey), voucher Kew: AY581802; ***Pimpinella tragium*** Vill. subsp. ***pseudotragium*** (DC.) Matthews, Kicilcahamam (Ankara, Turkey), June 2001 ESSE 13874: AY581805; ***Pilopleura goloskokovii*** (Korov.) Pimenov, M.G.Pimenov, voucher M.G.Pimenov et al. No.512 (MW): FJ489384 and FJ489353; ***Pleurospermum hookeri*** var. ***thomsonii*** C.B. Clarke, Ma'an Mtn. (Sichuan, China) voucher ZJ0545: EU236199; ***Podistera nevadensis*** (A. Gray) S. Watson, Freel Peak, Lake Tahoe Basin Management Unit, El Dorado Co. (California, U.S.A.), Matson, voucher 27 Jul 2002 Matson 634 (ILL): AY146865 and AY146931; ***Polytaenia nuttallii*** DC. U.S.A., Illinois, Rock Island Co., North of Cordova, Rock Island Co. (Illinois, U.S.A.), Evers, voucher Evers 110464 (ILLS): AF358516 and AF358583; ***Polytaenia nuttallii*** DC., McLellan Co. (Texas, U.S.A.), F. R. Barrie, voucher F. R. Barrie 1406 (RM 529215): KF619728; ***Polytaenia texana*** (J.M. Coult. & Rose) Mathias &

Constance, East of Briggs, Burnet Co. (Texas, U.S.A.), voucher 25 May 1985, Barrie 1403 (RM): AY146867 and AY146933; ***Prionosciadium madrense*** S.Watson, Pennington, voucher Pennington 229 (TEX): JQ304999; ***Prionosciadium madrense*** S.Watson, Maysilles, voucher Maysilles 7810 (MICH): GQ862508; ***Psammogeton biternatum*** Edgew., Punjab (India), R. Stewart, voucher R. Stewart 13791: AF164839 and AF164864; ***Psammogeton lamondiae*** Engstrand & Rech., Baluchistan (Pakistan), Rechinger, voucher Rechinger 27870 (B): MG827073; ***Psammogeton ranunculifolius*** (Boiss.) Engstrand, Hoshab-Panjgur, Makran (Baluchistan, Pakistan), Lamond, voucher Lamond 573 (MW): MG920277; ***Pseudocymopterus montanus*** (A. Gray) J. M. Coult. & Rose**,** Dunckley Flat Tops, Río Blanco Co., (Colorado, U.S.A.), Vanderhorst, voucher 17 June 1991 Vanderhorst 2637 (RM): AF358520 and AF358587; ***Pseudocymopterus montanus*** (A. Gray) J. M. Coult. & Rose**,** AY265989 and AY266447; ***Pseudocymopterus montanus*** (A. Gray) J. M. Coult. & Rose, Gila Co. (Arizona, U.S.A.), C. E. Hinchliff, voucher C. E. Hinchliff 1288 (CIC 040926): KF619729; ***Pternopetalum davidii*** Franch., China, Yunnan, Luohan Ping, Suijiang (Yunnan, China) voucher ZJ06 (KUN): EU236205; ***Pterygopleurum neurophyllum*** (Maxim.) Kitag.: AY509127; ***Pteryxia petraea*** (M. E. Jones) J. M. Coult. & Rose. Oregon: Malheur Co. (Oregon, U.S.A.) D. Mansfield, voucher D. Mansfield 12–496 (CIC 043140): KF619730; ***Pteryxia terebinthina*** var. ***foeniculacea*** (Torr. & A. Gray) Mathias, Idaho: Custer Co. (Idaho, U.S.A.), C. E. Hinchliff, voucher C. E. Hinchliff 1344 (CIC 043327): KF619616; ***Pteryxia terebinthina*** var. ***terebinthina*** (Hook.) J. M. Coult. & Rose, Grant Co., (Washington, U.S.A.), C. E. Hinchliff, voucher C. E. Hinchliff 1271 (CIC 040911): KF619733; ***Rhodosciadium pringlei*** S.Watson McVaugh, voucher McVaugh 19800 (MICH): GQ862530; ***Ridolfia segetum*** (L.) Moris, along side river Jordan, Wadi Al-Yabis (Jordan) from material cultivated in Yarmouk University Herbarium Irbid (Irbid, Jordan), Lahham and El-Oqlah, voucher Lahham & El-Oqlah 12: U78384 and U78444; ***Ridolfia segetum*** (L.) Moris, from material of the Conservatoire Botanique de Mulhouse, Mulhouse (Alsace, France), J.-P. Reduron, voucher J.-P. Reduron 01047: GQ148796; ***Ridolfia segetum*** (L.) Moris, Granada (Andalucía, Spain), C. Morales, voucher C. Morales et al. s.n. (MA): KJ473895; ***Rupiphila tachiroei*** (Franch. & Sav.) Pimenov & Lavrova: AY328952 and AY330518; ***Rupiphila tachiroei*** (Franch. & Sav.) Pimenov & Lavrova, voucher LZ0940(KUN): MK036621; ***Rumia crithmifolia*** Koso-Pol. Ukraine, Tsvelev, voucher Tsvelev 146 26-VI-1981 (LE): GQ379273; ***Sajanella monstrosa*** Willd, M.G. Pimenov, voucher M.G.Pimenov et al. No.453 (MW): FJ489339 and FJ489371; ***Sanicula europea*** L., Spain, P. Catalan, voucher P. Catalan 1896 (JACA): AF031964; ***Sanicula europea*** L., Santuario de Covadonga, Cangas de Onís (Asturias, Spain), Víctor Vázquez and José Antonio Fernández Prietovoucher FCO:37746: MH377872; ***Saposhnikovia divaricata*** (Turzc) Schischk, Kazakhstan, Karamysheva and Rachkovskaja, voucher Karamysheva & Rachkovskaja 7M 17-VIII-1958 (LE): GQ379274; ***Selinum carvifolia*** (L.) L., Herbsheim-Boofzheim (Bas-Rhin, France), Reduron, voucher 14 August 2001 Reduron s. n. (ILL): AY179028; ***Selinum carvifolia*** (L.) L., Perchuschkovo (Kaluga, Russia), Datzuk, voucher 5.07.1991. Datzuk (MW): AY328930 and AY330496; ***Selinum carvifolia*** (L.) L., voucher O-391715: MN662954; ***Selinum pyrenaeum*** Gouan Markstein, Vosges (Haut-Rhin, France), Reduron, voucher 24 July 2001 Reduron s. n. (ILL): AY179027; ***Seseli tortuosum*** L., cultivated in the Conservatoire Botanique d'Alsace, Mulhouse (Alsace, France) from material of Sintra Praja das Macas (Lisboa, Portugal), Hildenbrand, Meyer and Reduron, voucher no. 98042, 2 August 2001 Hildenbrand, Meyer & Reduron s.n.: AY179031;

Shoshonea pulvinata Evert & Constance, Logan Mtn., Park County (Wyoming, U.S.A.), Evert, voucher Evert 10623 (RM): U78460 and U78400; ***Shoshonea pulvinata*** Evert & Constance, Park Co. (Wyoming, U.S.A.), W. Fertig, voucher W. Fertig 15327 (RM 613328): KF619734; ***Sinocarum coloratum*** (Diels) H. Wolff ex R.H. Shan & F.T. Pu, YuLong Snow Mtn. (Yunnan, China), voucher KUN:YL561: FJ385063; ***Spermolepis inermis*** (Nurr. ex DC.) Mathias & Constance, USA, Illinois, Rock Island Co., Cordova Rock Island Co. (Illinois, U.S.A.), R. A. Evers, voucher R. A. EVERS 80062 (ILLS): AF008602 and AF009081; ***Sphenosciadium capitellatum*** A. Gray, Oregon (U.S.A.), G. Mason, voucher G. MASON 7531 (ILL): AF008600 and AF009079; ***Spuriopimpinella calycina*** (Maxim.) Kitag., Japan, Ohwi, voucher Ohwi 126 4-IX-1950 (G): GQ379330; ***Stenocoelium athamantoides*** Ledeb., M. G. Pimenov, voucher M.G.Pimenov et al. No.447 (MW): FJ489385 and FJ489354; ***Taenidia integerrima*** (L.) Drude, Lake View Park (Illinois, U.S.A.), Downie, voucher Downie 763 (ILL): U78399 and U78459; ***Tauschia texana*** A. Gray, Gonzales County (Texas, U.S.A.), Barrie, voucher Barrie 1435 (RM) :AF358592 and AF358525; ***Thaspium barbinode*** (Michx.) Nutt., North of Tolono, Champaign Co. (Illinois, U.S.A.), Ulaszek, voucher 12 June 1990 Ulaszek 1484 (ILLS): AF358526 and AF358593; ***Thaspium barbinode*** (Michx.) Nutt., Ozark Trail, Mark Twain Forest, Wayne Co. (Missouri, U.S.A.,), Brant, voucher Brant 3900 (MO 4900599): MT707549; ***Thaspium pinnatifidum***, voucher Wofford et al. THA-11-13, 5/23/2000 (TENN): MK355979; ***Thaspium trifoliatum***(L.) A. Gray, Urbana (Illinois, U.S.A.), Downie, voucher Downie 744 (ILL): U78410 and U78470.1; ***Thecocarpus meifolius*** Boiss., Jasuj, Zagros Mtns. (Boyerahmad va Kohgiluye, Iran), M. G. Pimenov, E. V. Kluykov, A. K. Sytin and F. G haremandinejad, voucher MW 211: AY941290 and AY941318; ***Thecocarpus meifolius*** Boiss., voucher 97167-TARI: MT254224; ***Thysselinum palustre*** (L.) Hoffm. (=*Peucedanum palustre* (L.) Moench), Bemowo (Warszawa, Poland), Kirpluk, voucher 23 August 1985 Kirpluk s. n. (WA): AY179035; ***Tilingia ajanensis*** Regel & Til., Cheshov Mtn. (Saghalien, Russia), Pimenov and Kljuykov, voucher Pimenov & Kljuykov 139 (MW): AY328939 and AY330505; ***Tilingia ajanensis*** Regel & Til., voucher M16-5: LC554281; ***Tommasinia verticillaris*** Bertol., cultivated in Moscow State University Botanical Garden, Moscow (Russia): AF008609 and AF009088; ***Tordylium aegyptiacum*** (L.) Lam., Lahham & El-Oqlah , Jordan, cultivated in Yarmouk University Herbarium (Irbid, Jordania), Lahham and El-Oqlah, voucher Lahham & El-Oqlah 11 :EU169328; ***Tordylium apulum*** L., Izmri (Turkey), Davis, Davis 41835: EU185679; ***Tordylium elegans*** (Boiss. & Balansa) Alava & Hub.-Mor., Adan (Turkey), Alava 6694 :EU185664; ***Tordylium maximum*** L. Georgia, between Ambrolauri-Oni, Georgia, M. G. Pimenov, voucher 15.08.1973. M. G. Pimenov 744 (MW)*:* DQ996585; ***Tetrataenium canescens*** Lindl.,Nainital, Uttar Pradesh (India), Pimenov and Kljuykov voucher Pimenov and Kljuykov (MW): KY851299; ***Tetrataenium nepalense*** (D.Don) Manden: HQ686493; ***Tetrataenium nepalense*** (D.Don) Manden: DQ427036; ***Trinia hispida*** Hoffm., Russia, Botschkin, voucher Botschkin & al. 70 (MO 04985260) DNA No. 2127:EU169330 ; ***Vicatia coniifolia*** Woll ex DC, King, voucher King 1132 (E 00059551): EU169331; ***Xanthoselinum alsaticum*** (L.) Schur (=*Peucedanum alsaticum* L.), Westhalten (Haut-Rhin, France), Reduron, voucher 21 August 1979 Reduron s. n. (WA): AH012697 (=AF495834 and AF495835), ***Zizia aurea*** (L.) Koch., cultivated in ther Jardin Botanique de Montréal, Downie, voucher (no. 60) Downie 8 (ILL): AH003554 (=U30574 and U30575), ***Zizia aurea*** Koch. Kansas: Cherokee Co. (Kansas, U.S.A.), R. L. McGregor, voucher R. L. McGregor 32898 (RM 527763): KF619741; ***Zizia***

aurea (L.) Koch., voucher DPP61: MT610976, ***Zosima orientalis*** Hoffm., Tortum-Erzerum (Turkey) from material cultivated in Moscow State University Botanical Garden (Moscow, Russia), M. G. Pimenov, voucher M. G. PIMENOV & al. s.n. (MW): AF008628 and AF009107.

List of *Angelica* taxa and sequences generated in previous studies used in the trnL phylogenetic analysis. The order of the displayed data corresponds to the following information: taxon name, collection site, collector, voucher and GenBank accession numbers.

Angelica sylvestris L., from material cultivated of UIUC from Shanghai Botanic Garden (Shanghai, China), Downie, voucher Downie 428 (ILL): AY379236; ***Angelica sylvestris*** L.: GQ244572; ***Angelica sylvestris*** L., voucher isolate 0760g: GQ244569; ***Angelica sylvestris*** L., voucher isolate P28: KF718351.

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Table 1. Number of European genera of *Angelica* s.l. proposed by different authors. Genera considered treated as different from *Angelica* in the reference are indicated with a plus sign (+), while untreated taxa are indicated by a dot (.) Gray squares indicates that the taxon has been considered as synonymous of other species, the Synonyms species are indicated in brackets.

Genus	**Linnaeus (1753)**	**Cannon & Tutin (1968)**	**EURO+MED (2011)**	**Liao et al. (2020)**
Angelica L. (1753)	+	+	+	+
Archangelica Wolf (1776)	*Angelica archangelica* L. (1753)	*Angelica archangelica* L. (1753)	*Angelica archangelica* L. (1753)	*Angelica archangelica* L. (1753)
Ostericum Hoffm. (1816)	.	*Angelica palustris* (Besser) Hoffm. (1814)	+	+

Table 2. European species of *Angelica* proposed by different authors. Species treated in the reference are indicated with a plus sign (+), while untreated taxa are indicated by a dot (.) Gray squares indicate that the taxon has been considered as synonymous to other species (synonyms are indicated in brackets). Iberian or Pyrenean endemic taxa are indicated with an asterisk (*).

	Lange (1874-1880)	**Cannon & Tutin (1968)**	**Guitiérrez Bustillo (1981), *Flora Iberica***	**Reduron (2007)**	**EURO+MED (2011)**
Angelica angelicastrum (Hoffmanns. & LinK) Cout. (1913)*	.	+	[*Angelica major* Lag. (1816)]*	.	[*Angelica major* Lag. (1816)]*
Angelica archangelica L. (1753)	.	+	.	+	+
Angelica decurrens (Lebdeb.) B. Fedtsch (1909)	.	[*Angelica archangelica* ssp. a*rchangelica* L. (1753)]	.	.	+
Angelica heterocarpa J. Llyod (1860)	.	+	.	+	+
Angelica laevis.Gay ex Fisch. & C.A.Mey (1843)*	.	+	[*Angelica major* Lag. (1816)]*	.	[*Angelica major* Lag. (1816)]*
Angelica major Lag. (1816)*	+	[*Angelica sylvestris* L. (1753)]	+	[*Angelica archangelica* L. (1753)]	+
Angelica palustris (Besser) Hoffm. (1814)	.	+	[*Ostericum pratense* Hoffm. (1816)]	.	[*Ostericum pratense* Hoffm. (1816)]
Angelica pachycarpa Lange (1864)	+	+	+	+	+

Angelica pyrenaea (L.) Spreng (1813)*	[*Selinum pyrenaeum* (L.) Gouan. (1773)]*	[*Selinum pyrenaeum* (L.) Gouan. (1773)]*	[*Selinum pyrenaeum* (L.) Gouan. (1773)]*	[*Epikeros pyrenaicus* (L.) Raf. (1840)]*	+
Angelica razulii Gouan. (1773)*	+	+	+	+	+
Angelica reuteri Boiss. (1856)*	-	[*Angelica sylvestris* L. (1753)]	[*Angelica major* Lag. (1816)]*	-	-
Angelica sylvestris L. (1753)	+	+	+	+	+

Table 3. Samples of *Angelica, Ostericum* and *Sanicula europaea* collected for this study.

Taxon	Code	Genbank Accession number	Site of collection / Voucher	Coordinates (latitude, longitude)	Collector
***Angelica archangelica* L. (1753)**	AARC1	ITS: OQ064632 *trnL*:OQ060687	Cultivated in Jardín Botánico Atlántico (JBA) de Gijón (Asturias, Spain) / FCO: 40961	43.521509, -5.615900	A. Bueno
***Angelica heterocarpa* Lloyd (1860)**	AHET1	ITS: OQ064633 *trnL*:OQ060688	Right riverbank of Adour river, Bayonne-Lartigue, Atlantic Pyrenees (Pyrénées-Atlantiques, France) / FCO: 40962	43.498830, -1.140511	M. Ceballos de Horna, M. Fdez. Ceballos & J.A. Fdez. Prieto
	AHET2	ITS: OQ064634 *trnL*:OQ060689	Right riverbank of Adour river, Bayonne-Lartigue, Atlantic Pyrenees (Pyrénées-Atlantiques, France) / FCO: 40963	43.497533, -1.378182	M. Ceballos de Horna, M. Fdez. Ceballos & J.A. Fdez. Prieto
	AHET3	ITS: OQ064635 *trnL*:---	Right riverbank of Adour river, Bayonne-Lartigue, Atlantic Pyrenees (Pyrénées-Atlantiques, France) / FCO: 40964	43.50174, -1.346874	M. Ceballos de Horna, M. Fdez. Ceballos & J.A. Fdez. Prieto
***Angelica laevis*, J.Gay ex Fisch. & C.A.Mey (1843)**	ALAE1	ITS: OQ064636 *trnL*:OQ060690	Port of Pajares, between Arbás del Puerto and el Brañilín (León, Castilla y León, Spain) / FCO: 40965	42.990768, -5.752714	A. Fdez. Ceballos & J.A. Fdez. Prieto
	ALAE2	ITS: OQ064637 *trnL*:OQ060691	Port of Pajares, between Busdongo and Arbás del Puerto (León, Spain) / FCO: 40966	42.992095, -5.743954	A. Fdez. Ceballos & J.A. Fdez. Prieto

	ALAE3	ITS: OQ064638 *trnL*:OQ060692	Port of Leitariegos, nearby la Venta de la Farruquita (Asturias, Spain) / FCO: 40967	43.022144, -6.449024	V. Vázquez & J.A. Fdez. Prieto
	ALAE4	ITS: OQ064639 *trnL*:OQ060693	Near the port of Leitariegos (Asturias, Spain) / FCO: 40968	42.995874, -6.415972	V. Vázquez & J.A. Fdez. Prieto
	ALAE5	ITS: OQ064640 *trnL*:OQ060694	De Suares al Plano, Bimenes (Asturias, Spain) / FCO: 40969	43.338852, -5.594057	H.S. Nava
	ALAE6	ITS: OQ064641 *trnL*:OQ060695	Pereda de Ancares-Tejeda de Ancares (León, Spain) / FCO: 40970	42.834291, -6.755010	M. Ceballos de Horma & J.A. Fdez. Prieto
	ALAE7	ITS: OQ064642 *trnL*:OQ060696	C. Sabugo River, Fonsagrada (Lugo, Spain) / FCO: 40971	43.22526, -7.160381	A. Bueno & J.A. Fdez. Prieto
	ALAE8	ITS: OQ064643 *trnL*:OQ060697	La Garganta, Villanueva de Oscos (Asturias, Spain) / FCO: 40972	43.346486, -7.012432	M. Ceballos de Horna, M. Fdez. Ceballos & J.A. Fdez. Prieto
***Angelica major* Lag. (1816)**	AMAJ1	ITS: OQ064644 *trnL*:OQ060698	Portillo de la Sía (Cantabria-Burgos, Spain) / FCO: 40973	43.176908, -3.573379	M. Ceballos de Horna, M. Fdez. Ceballos & J.A. Fdez. Prieto

	AMAJ2	ITS: OQ064645 *trnL*:OQ060699	Portilla de Lunada (Cantabria, Spain) / FCO: 40974	43.153010, -3.573156	M. Ceballos de Horna, M. Fdez. Ceballos & J.A. Fdez. Prieto
	AMAJ3	ITS: OQ064646 *trnL*:OQ060700	Covaleda (Soria, Castilla y León, Spain) / FCO: 40975	41.941408, -2.887904	A. Bueno & J.A. Fdez. Prieto
	AMAJ4	ITS: OQ064647 *trnL*:OQ060701	Villoslada de Cameros-Lumbreras (La Rioja, Spain) / FCO: 40976	42.114866, -2.641459	A Bueno & J.A. Fdez. Prieto
***Angelica pachycarpa* Lange (1864)**	APAC1	ITS: OQ064648 *trnL*:OQ060702	Cabo de Peñas, Gozón, cultivated in JBA de Gijón (Asturias, Spain) / FCO: 40977	43.640622, -5.840844	A. Bueno
	APAC2	ITS: OQ064649 *trnL*:OQ060703	Punta de Morás (Lugo, Galicia, Spain) / FCO: 40978	42.105777, -7.511960	M. Ceballos de Horna & J.A. Fdez. Prieto
	APAC3	ITS: OQ064650 *trnL*:---	Oleiros Beach, Cudillero (Asturias, Spain) / FCO: n.d.	43.586386, -6.225475	M. Ceballos de Horna & J.A. Fdez. Prieto
	APAC4	ITS: OQ064651 *trnL*:---	Navia Beach (Asturias, Spain) / FCO: n.d.	43.555887, -6.720303	M. Ceballos de Horna y J.A. Fdez. Prieto

	APA5L	ITS: OQ064675 *trnL*:---	West of Luarca's lighthouse, Luarca (Asturias, Spain) / FCO: 40832	43.549658, -6.532500	H.S. Nava
	APA6CO	ITS: OQ064676 *trnL*:---	Near the lighthouse of Cabo de San Agustín Cape,Ortiguera, Coaña (Asturias, Spain) / FCO: 40833	43.564134, -6.732477	H.S. Nava
	APA8GI	ITS: OQ064677 *trnL*:---	Campa torres, Gijón (Asturias, Spain) / FCO: 40831	43.566078, -5.705356	H.S. Nava
	APAL1	ITS: OQ064652 *trnL*:OQ060704	Uckermark-Randowbruch (Brandeburg, Germany) / FCO: n.d.	53.383329, 13.916668	J.A. Fdez. Prieto & E. Cires
	APAL2	ITS: OQ064653 *trnL*:OQ060705	Wroclaw (Breslavia, Poland) / FCO: n.d.	51.127800, 16.997423	J.A. Fdez. Prieto & E. Cires
***Ostericum palustre* (Besser) Besser (1822)**	APAL3	ITS: OQ064654 *trnL*:OQ060706	Havelgebiet (Brandeburg, Germany) / FCO: n.d.	52.533331, 13.033327	J.A. Fdez. Prieto & E. Cires
	APAL4	ITS: OQ064655 *trnL*:OQ06070	Leipziger (Saxony-Anhalt, Germany) / FCO: n.d.	51.449991, 12.049991	J.A. Fdez. Prieto & E. Cires

***Angelica pyrenaea* Spreng. (1813)**	APYR1	ITS: OQ064656 *trnL*:OQ060708	Sorteny (Andorra) / FCO: n.d.	42.620530, 1.580750	J.A. Fdez. Prieto & E. Cires
	APYR2	ITS: OQ064657 *trnL*:OQ060709	Formigueres -Mirepoix, Eastern Pyrenees, (Pyrénées-Orientales, Occitania, France) / FCO: n.d.	42.731764, 1.988900	J.A. Fdez. Prieto & E. Cires
***Angelica razulii* Gouan (1773)**	ARAZ1	ITS:--- *trnL*:OQ060710	Ortzansurieta-Orbaiceta (Navarra, Spain) / BIO: 24466	43.004015, -1.227571	J. Loidi, J.A. Campo, A Berastegui & A. Darquistade
	ARAZ2	ITS: OQ064658 *trnL*:OQ060711	Ibón Baños Balneario, pie Argualas (Huesca, Aragón, Spain) / JACA: 237500	42.752156, -0.238632	P. Montserrat
	ARAZ3	ITS: OQ064659 *trnL*:OQ060712	Balneario de Panticosa, riverbanks near Bachimaña (Huesca, Aragón, Spain) / JACA: 265366	42.767509, -0.231155	L. Villar
	ARAZ4	ITS: OQ064660 *trnL*:OQ060713	Arinsal, riverbanks of Truites river (Andorra) / JACA: 184492	42.577466, 1.476947	P. Montserrat, D. Gómez & J.L. Benito
	ARAZ5	ITS: OQ064661 *trnL*:OQ060714	La Rivereta, Pinar dels Clots, San Juan de Plan (Huesca, Aragón, Spain) / JACA: 273390	41.904224, 1.394644	J.V. Ferrández

	ARAZ6	ITS: OQ064662 *trnL*: OQ060715	Valle de Literola, Benasque (Huesca, Aragón, Spain) / JACA: 359497	42.656908, 0.532517	J.V. Ferrández
***Angelica reuteri* Boiss. (1856)**	AREU1	ITS: OQ064663 *trnL*:OQ060716	La Covatilla, Sierra de Béjar (Salamanca, Castilla y León, Spain) / FCO: 40979	40.353159, -5.684065	M. Ceballos de Horna, M. Fdez. Ceballos & J.A. Fdez. Prieto
	ASYL1	ITS: OQ064664 *trnL*:OQ060717	Cultivated in the alder grove of the JBA de Gijón (Asturias, Spain) / FCO: 40982	43.520343, -5.618540	A. Bueno
	ASYL2	ITS: OQ064665 *trnL*:OQ060718	Covadonga, Cangas de Onís (Asturias, Spain) / FCO: 40983	43.307292, -5.053215	V. Vázquez & J.A. Fdez. Prieto
***Angelica sylvestris* L. (1753)**	ASYL3	ITS: OQ064666 *trnL*:OQ060719	Pas de Peyrol, Puy Mary, Massif Central (Cantal, France) / FCO: 40984	45.133531, 2.717557	M. Ceballos de Horna, M. Fdez. Ceballos & J.A. Fdez. Prieto
	ASYL4	ITS: OQ064667 *trnL*:OQ060720	Trubia-Oviedo (Asturias, Spain) / FCO: 40985	43.347476, -5.889873	M. Ceballos de Horna, M. Fdez. Ceballos & J.A. Fdez. Prieto
	ASYL5	ITS: OQ064668 *trnL*:OQ060721	Upper Lusatia, village Dürrbach (Saxony, Germany) / FCO: 40986	51.355955, 14.626202	P. Gebanv

ASYL6	ITS: OQ064669 *trnL*:OQ060722	Mosset -La Moulinasse, Eastern Pyrenees (Pyrénées-Orientales, Occitania, France) / FCO: 40987	42.503182, 2.099611	M. Ceballos de Horna, M. Fdez. Ceballos & J.A. Fdez. Prieto
ASYL7	ITS: OQ064670 *trnL*:OQ060723	Cabanasse-Bolquere, Eastern Pyrenees (Pyrénées-Orientales, Occitania, France) / FCO: 40988	42.503180, 2.099611	M. Ceballos de Horna, M. Fdez. Ceballos & J.A. Fdez. Prieto
ASYL8	ITS: OQ064671 *trnL*:OQ060724	Arán-Bagneres de Luchon (Lérida, Cataluña, Spain) / FCO: 40989	42.761294, 0.658172	S. Rivas-Martínez & J.A. Fdez. Prieto
An 334	ITS:--- *trnL*:OQ060725	Kepsha, near Sochi (Krasnodar Krai, Russia) / MW: 0700334	43.613888, 40.063888	Polina A. Volkova
An 523	ITS: OQ064673 *trnL*:---	Near Mamai, Baikal lake (Buryatia, Russia) / MW: 0159523	51.492000, 104.841662	Polina A. Volkova
An 001	ITS: OQ064672 *trnL*:---	Pskov Oblast (Russia) / MW: 0459001	57.121565, 30.365512	Polina A. Volkova
An 555	ITS:--- *trnL*:OQ060726	Murmansk Oblast (Terskii, Russia) / MW: 0458555	66.677570, 33.881620	Polina A. Volkova

***Sanicula europaea* L. (1753)**	SEU	ITS: OQ064674 *trnL*:---	Covadonga, Cangas de Onís (Asturias, Spain) / FCO: 37746	43.31235, -5.059108	V. Vázquez & J.A. Fdez. Prieto

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Table 4. Main features of the European ITS, Apioideae ITS and *trnL* alignments used for the phylogenetic analyses. Variable sites are positions in the alignment containing a minimum of two different nucleotides, they were considered to be parsimonious-informative sites when each of the nucleotides had at minimum frequency of two in the alignment.

	European ITS	**Apiodae ITS**	***trnL***
Analized *Angelica* taxa	12	67	11
Number of sequences	78	478	44
Range of length of sequences (pb)	537-606	398-611	274-510
Alignment length (pb)	633	699	518
(C+G) %	56.1	55.7	34.9
Conserved sites	476	185	446
Variable sites	136	494	64
Parsimomious-informartive sites	114	410	17
Singletons**	22	76	47

**Here singletons are considered following the MEGA X criteria (Kumar et al., 2018), when ambiguities are located at a particular site by at least 3 different sequences.

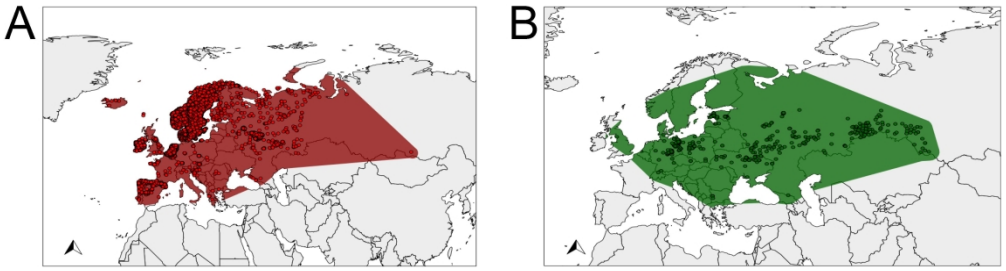

Figure 1. Global distribution of the *Angelica* s. l. genera *Angelica* (A) and *Ostericum* (B) taxa occurring in Europe based on this study's occurrences and the occurrences available at GBIF (https://www.gbif.org/).

167x44mm (600 x 600 DPI)

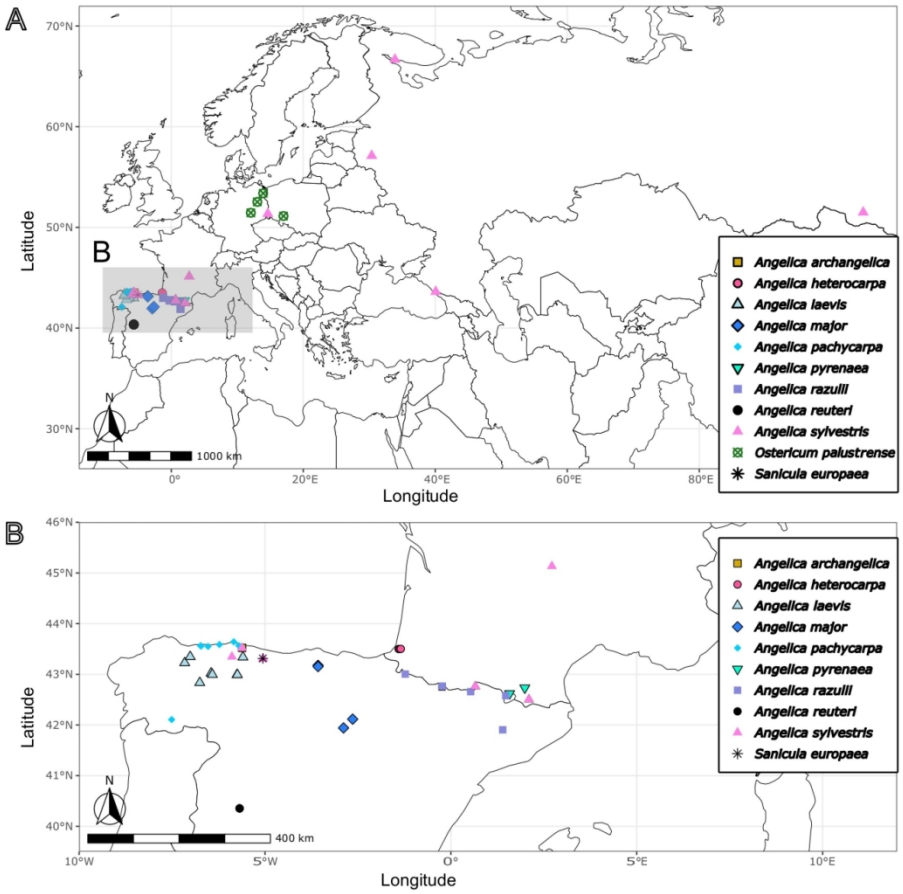

Figure 2. A). Sampling sites of *Angelica*, *Ostericum* and *Sanicula europaea* samples in Europe. B). detailed sampling sites of the Iberian Peninsula and France (B).

123x118mm (300 x 300 DPI)

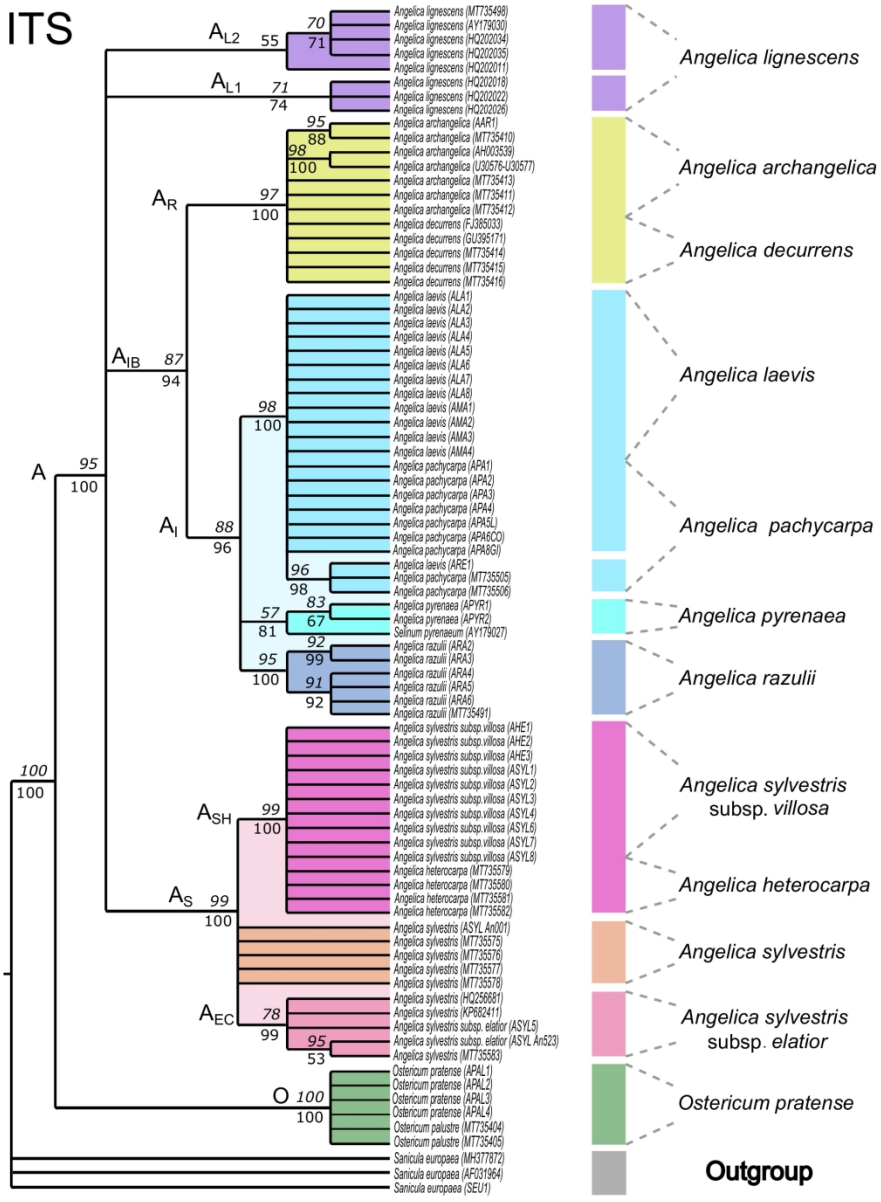

Figure 3. Consensus tree obtained from the ML and BI analyses of the European ITS dataset. Branch support values are displayed in italics over the branches which correspond to bootstrap value (BT) from the ML analysis ranging from 0 to 100, while the numbers under the branches correspond to the posterior probability (PP) of the BI analysis ranging from 1 to 100. Abbreviations correspond to *Angelica archangelica* (AARC), *Angelica heterocarpa* (AHET), *Angelica laevis* (ALAE), *Angelica major* (AMAJ), *Ostericum palustre* (=*Angelica palustris*) (APAL), *Angelica pachycarpa* (APAC), *Angelica pyrenaea* (APYR), *Angelica razulii* (ARAZ), *Angelica reuteri* (AREU), *Angelica sylvestris* (ASYL) and *Sanicula europea* (SEU).

175x229mm (600 x 600 DPI)

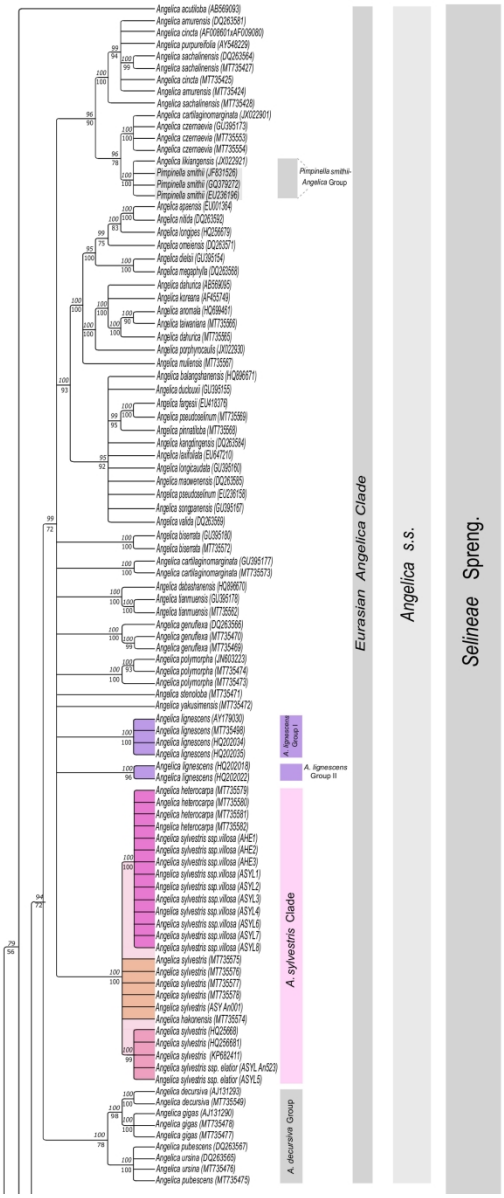

Figure 4. Part I of the consensus tree obtained from the BI and ML analyses of the Apioidae dataset. The numbers under the branches correspond to PP values obtained in the BI analysis, while numbers over the branches correspond to the BT values obtained in the ML analysis. The clades comprising the samples of *Angelica sylvestris* have been highlighted in pink-orange, while clades comprising *Angelica lignescens* have been highlighted in purple. Abbreviations correspond to *Angelica heterocarpa* (AHE) and *Angelica sylvestris* (ASYL).

210x297mm (600 x 600 DPI)

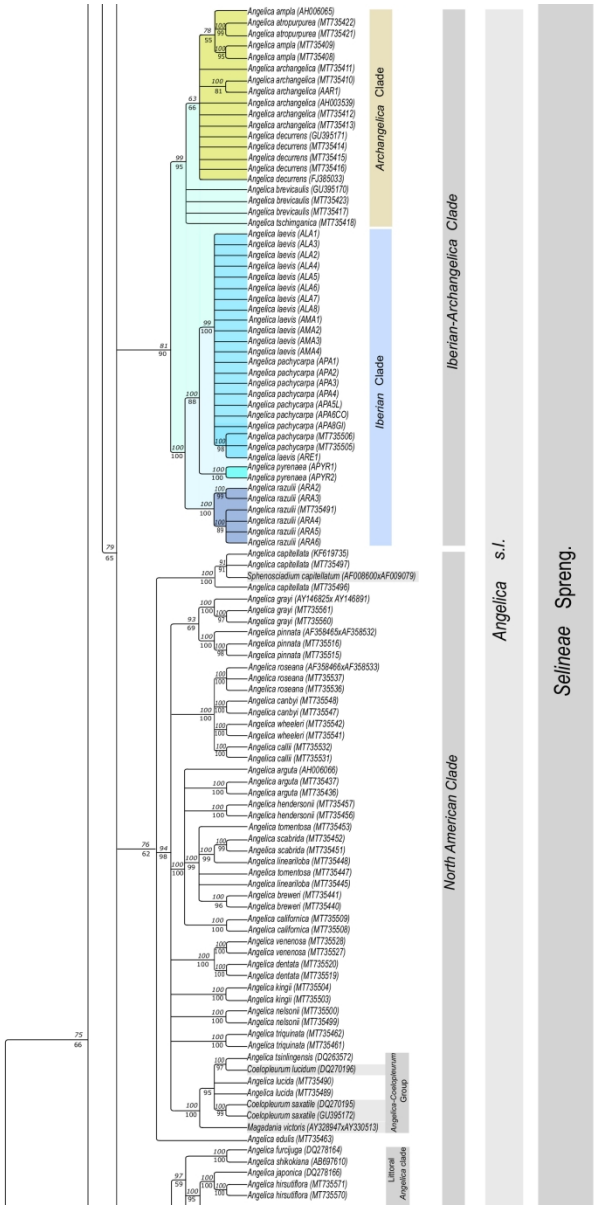

Figure 5. Part II of the consensus tree obtained from the BI and ML analyses of the Apioidae dataset. The numbers under the branches correspond to PP values obtained in the BI analysis, while numbers over the branches correspond to the BT values obtained in the ML analysis. The clades comprising the samples the Iberian endemic species of *Angelica* have been highlighted in blue, while the Archangelica clade has been highlighted in yellow. Abbreviations correspond to *Angelica archangelica* (AAR), *Angelica laevis* (ALA), *Angelica major* (AMA), *Angelica pachycarpa* (APAC), *Angelica pyrenaea* (APYR), *Angelica razulii* (ARA) and *Angelica reuteri* (ARE).

210x297mm (600 x 600 DPI)

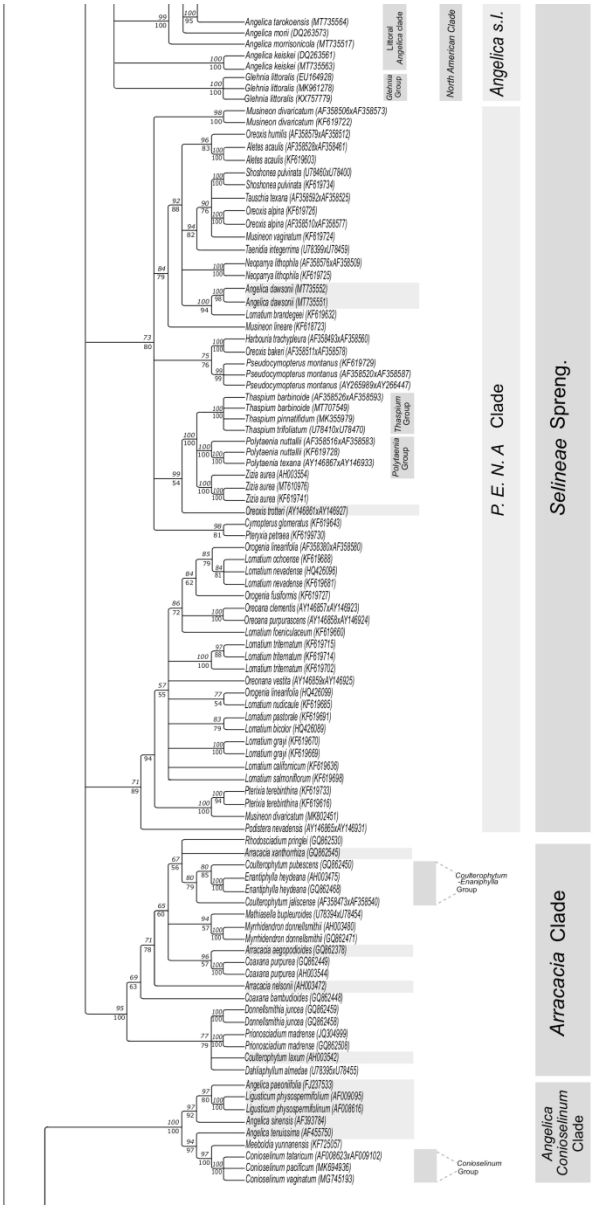

Figure 6. Part III of the consensus tree obtained from the BI and ML analyses of the Apioidae dataset. The numbers under the branches correspond to PP values obtained in the BI analysis, while numbers over the branches correspond to the BT values obtained in the ML analysis.

210x297mm (600 x 600 DPI)

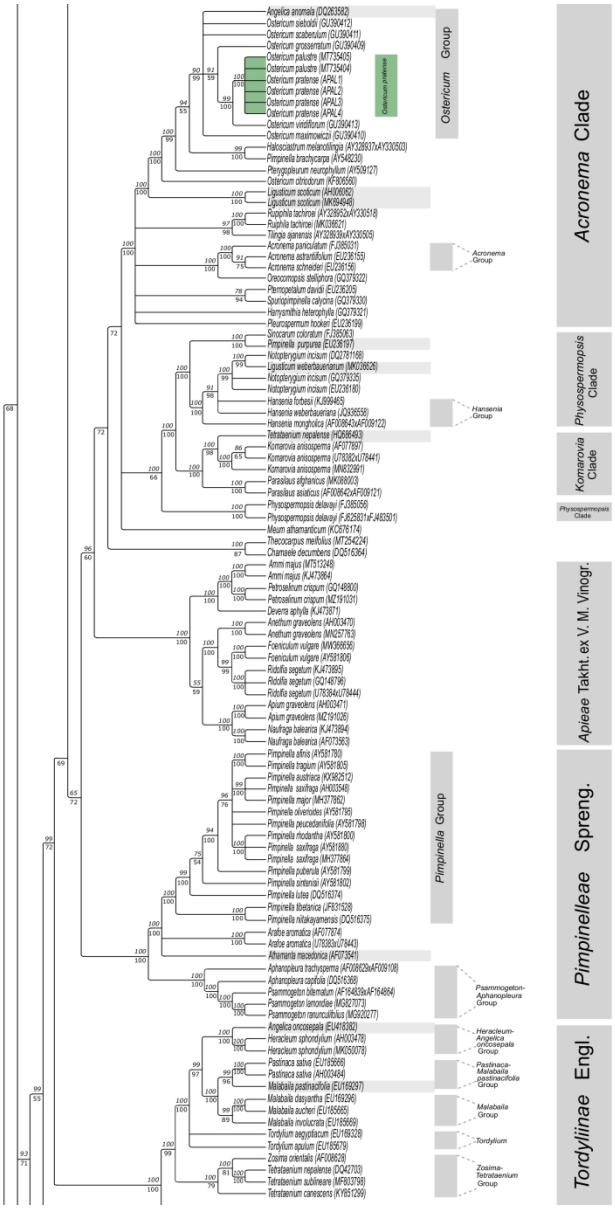

Figure 7. Part IV of the consensus tree obtained from the BI and ML analyses of the Apioidae dataset. The numbers under the branches correspond to PP values obtained in the BI analysis, while numbers over the branches correspond to the BT values obtained in the ML analysis. The clade comprising the samples of *Ostericum palustre* (=*Angelica palustris*) samples APAL1-4, have been highlighted in green.

210x297mm (600 x 600 DPI)

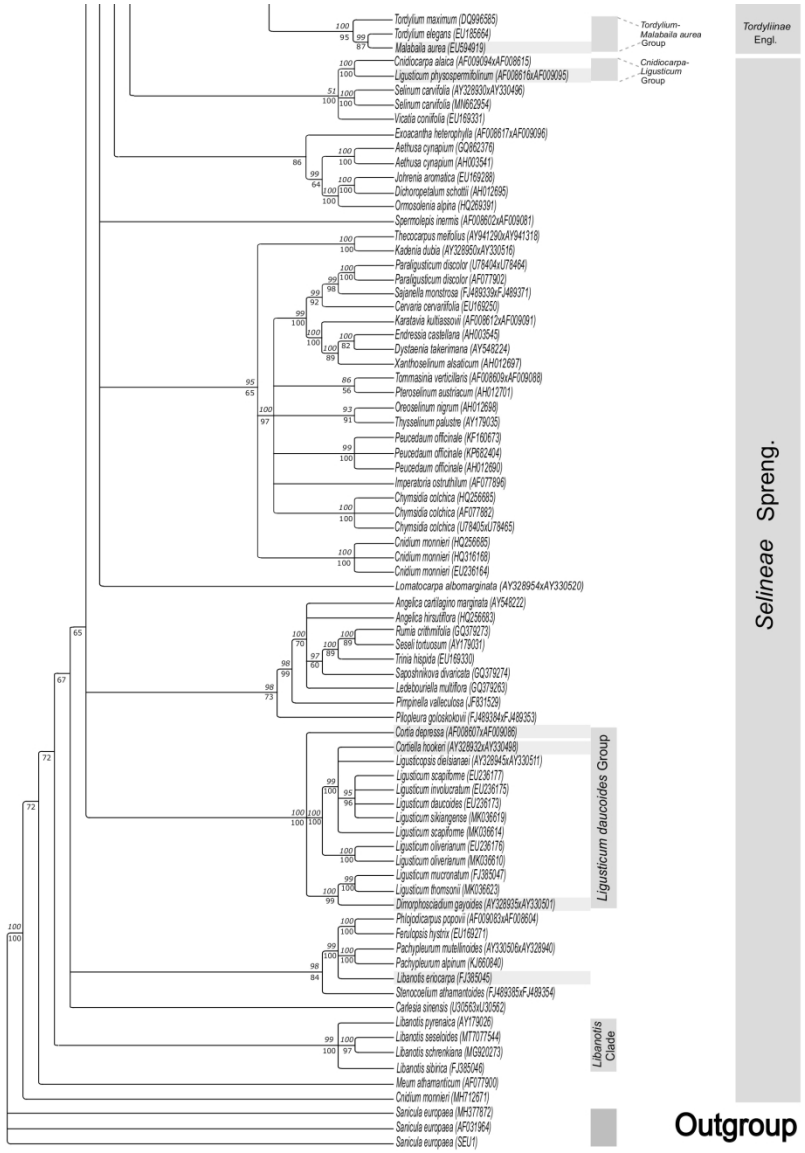

Figure 8. Part V of the consensus tree obtained from the BI and ML analyses of the Apioidae dataset. The numbers under the branches correspond to PP values obtained in the BI analysis, while numbers over the branches correspond to the BT values obtained in the ML analysis.

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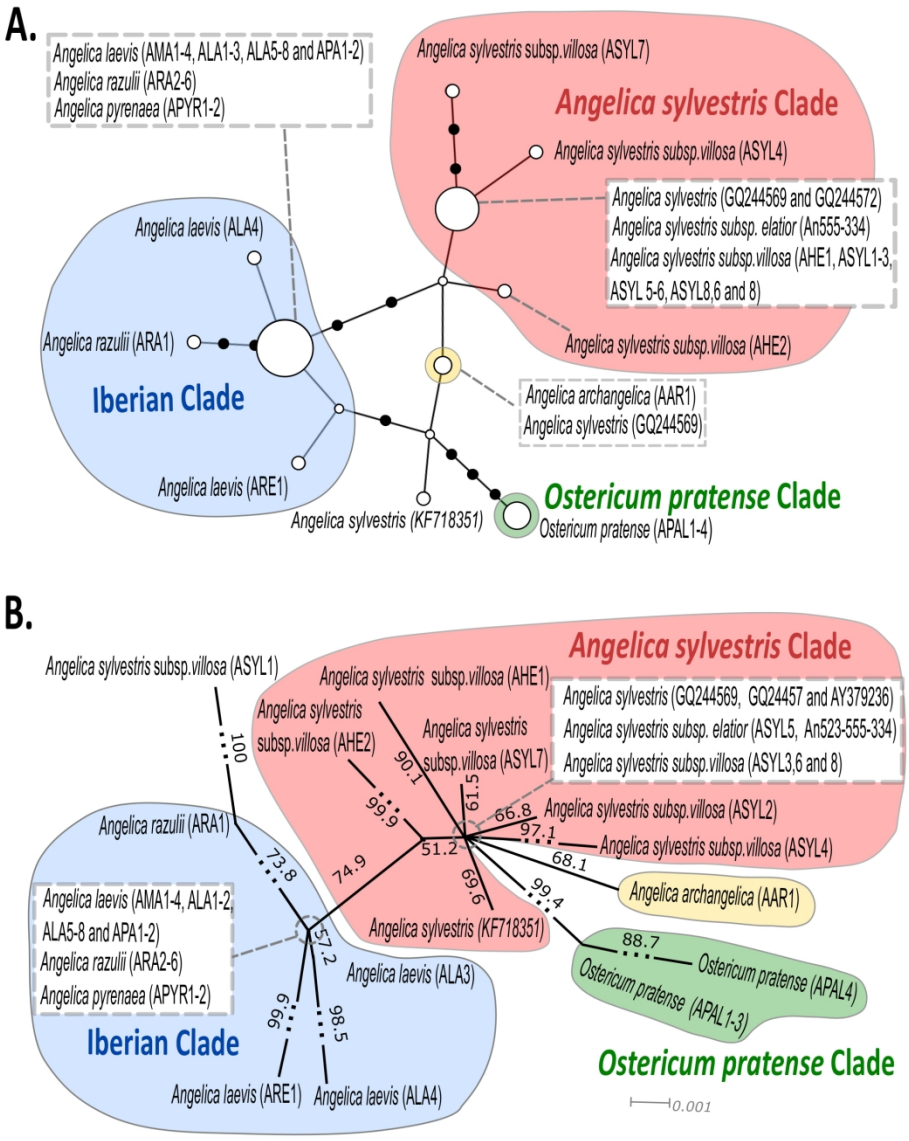

Figure 9. A). European *Angelica* species haplotype network obtained from trnL sequences by TCS, where black dots represent mutations and white circles represents nodes, their size being proportional to the number of individuals found in it. B). Gene geneanology by Neighbor-Net obtained from the trnL sequences of European *Angelica* and *Ostericum* samples. Bootstrap values, ranging from 0 to 100 (%), are shown over the branches.

175x229mm (600 x 600 DPI)