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Monograph

No taxon left behind? – a critical taxonomic checklist of *Carpinus* and *Ostrya* (Coryloideae, Betulaceae)

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Abstract. Hornbeams (*Carpinus*) and hop-hornbeams (*Ostrya*) are trees or large shrubs from the northern hemisphere. Currently, 43 species of *Carpinus* (58 taxa including subdivisions) and 8 species of *Ostrya* (9 taxa including sudivisions) are recognized. These are based on 175 (plus 16 Latin basionyms of cultivars) and 21 legitimate basionyms, respectively. We present an updated checklist with publication details and type information for all accepted names and the vast majority of synonyms of *Carpinus* and *Ostrya*, including the designation of 54 lectotypes and two neotypes. Cultivars are listed if validly described under the rules of the ICN. Furthermore, we consider *Carpinus hwai* Hu & W.C.Cheng to be a synonym of *Carpinus fargesiana* var. *ovalifolia* (H.J.P.Winkl.) Holstein & Weigend comb. nov. During the course of our work, we found 30 legitimate basionyms of non-cultivars that have been consistently overlooked since their original descriptions, when compared with the latest checklists and floristic treatments. As regional floras are highly important for taxonomic practice, we investigated the number of overlooked names and found that 78 basionyms were omitted at least once in the eight regional treatments surveyed. More seriously, we found 4 basionyms of accepted species being overlooked in a major floristic treatment.

Keywords. Herbarium digitization, taxon inventory, taxonomy, typification.

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Introduction

In the ongoing discussions on the loss of biodiversity and taxonomy crisis, inventories of taxon names are a crucial step. Floristic treatments and annotated checklists for countries, provinces or national parks are widely used as tools for biodiversity assessments, monitoring, and conservation (Palmer *et al.* 1995; Funk 2006). Regional projects are very important, but regional taxonomic treatments may be of limited use when wide-spread taxa are concerned. The narrow focus of regional treatments carries the risk of overemphasizing local variability and repeatedly describing more wide-spread taxa (Scotland & Wortley 2003; Michelangeli 2005). Therefore, taxonomically comprehensive lists as a baseline for taxonomic work are required. This need is addressed by, e.g., the series the *World Checklist of Selected Plant Families* (WCSP 2016) or *The PlantList* (http://www.theplantlist.org), with names and types available from nomenclatural databases such as *IPNI* (http://www.ipni.org) or *Tropicos* (http://www.tropicos.org).

The correct and valid application of taxon names (at the rank of family and below), however, is determined by designated taxonomic types (Art. 7.1. ICN; McNeill *et al.* 2012). Therefore, lists of names are only the initial step, since it is the type specimen that anchors the identity of the taxon. Obtaining type information, often deeply hidden in the historical literature, is a tedious process and the physical type specimens may be difficult to locate, but a correct and unequivocal typification is the crucial basis for disentangling taxonomic problems (Gaston & Mound 1993). Only then, as a feedback mechanism, treatments will be improved not only by data density, but also by data quality.

Almost 20 years ago, the *World Checklist and Bibliography of Fagales* (Govaerts & Frodin 1998) provided a baseline for the taxa of this order containing many species that constitute the temperate forests. However, critical taxonomic revisions are still scarce, with a revision of the genus *Betula* L. as a noteworthy exception (Ashburner *et al.* 2013). *Carpinus* L. and *Ostrya* Scop. belong to Betulaceae subfam. Coryloideae Hook.f. The species of the two genera are large shrubs or trees in forests nearly across the northern hemisphere. A few species are used for specialty timber or for landscaping and hedges, sometimes also as an ornamental, with *Carpinus betulus* L. and a range of cultivars of that species being by far the most important taxon. *Carpinus* and *Ostrya* are sister to the Chinese *Ostryopsis* Decne., a genus of three species (Holstein & Weigend 2016). While some studies find *Ostrya* to be paraphyletic to *Carpinus* (Grimm & Renner 2013), it is more often found nested in *Carpinus* (Yoo & Wen 2002, 2007; Li 2008). *Ostrya* is easily differentiated morphologically by having its nuts enclosed in pale, papery, inflated tubular bracts with a small blunt distal opening. Nuts of *Carpinus* are more or less exposed, at most half-covered by a side wing of the one large abaxial bract. An additional, minute, caducous, adaxial scale bract can be found in some East Asian species (*Carpinus* sect. *Distegocarpus* (Siebold & Zucc.) Sarg.) Currently, the *World Checklist of Selected Plant Families* (WCSP 2016) lists 42 accepted species of *Carpinus* and 8 of *Ostrya*, with both genera having a center of diversity in China. The revision of *Carpinus* for China by Hu (1933) is the latest critical taxonomic treatment on a larger geographical scale, while Furlow (1987) worked on the four North American taxa. The latest global key for *Carpinus* and *Ostrya* (Rushforth 1987) is an extension of the key from Li's Chinese floral treatment (Li 1979a). Here, we amend the current lists of taxa of *Carpinus* and *Ostrya* with further names based on extensive literature and *in silico* research, compare the taxonomic status of the names in various floras, and present typification data as far as available. Furthermore, we check the number of names not treated in the various treatments despite occurrences in the covered area to analyze the rate of overlooked taxa.

Material and methods

We assembled an initial list from the *World Checklist of Selected Plant Families* (WCSP 2016) and complemented it with names from *IPNI*, *The Plant List*, *Tropicos* and other sources. We took the acceptance status of *World Checklist of Selected Plant Families* as a baseline and compared the status and the basionyms of the corresponding synonyms with the recent literature (Furlow 1987; Chang *et al.* 2014a), and the appropriate floras, such as the *Flora of China* (Li & Skvortsov 1999), *Flora of Taiwan* (Liao 1996), *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012), *Flora of Japan* (Ohwi 1965), *Flora of North America* (Furlow 1997), and *Flora of the USSR* (Bobrov 1936).

In order to calculate the number of overlooked basionyms, names relating to cultivars (hanging branches, leaf color and maculation, and leaf serration mutants) were excluded. Illegitimate and invalid names were listed in the Supplementary File as they are sometimes mentioned and may represent evolutionary significant entities, but they were not included in the calculations either. A name was tagged as "missing" for a specific publication if it was not cited, although it should have been covered as it occurs in the focus area of the publication.

Type information for the names was identified from the protologues. The following herbaria were searched for type specimens *in situ*: B, BM, BR, E, GOET, K, LIV, M, MANCH, MSB, W, and WU.

Additional specimens were obtained via personal communication (DWC, LE, TBI) or *in silico*: *JSTOR Plant Science* (http://plants.jstor.org/), *Chinese Virtual Herbarium* (CDBI, IBK, IBSC, KUN, LBG, N, NAS, PE, WUK; http://www.cvh.org.cn/), *Hungaricana* (BP; http://gallery.hungaricana.hu/en/), *NHN Naturalis* (L, U, WAG), *Virtuella Herbariet* (LD, S; http://www.herbarium-ume.se/virtuella_herbariet), and the homepages of the following herbaria: A, F, GH, HK, LE, LINN, MICH, MO, NY, P, PH, TAI, TAIF, and US. Types of Korean taxa in Korean and Japanese herbaria are cited from Chang *et al.* (2014b).

Results

We found 175 legitimate basionyms for *Carpinus* (plus 16 for cultivars described under the rules of the ICN, two of them not formally mentioned as cultivars) and 21 for *Ostrya*. The list of non-cultivar basionyms with acceptance and taxonomic status, and the digital availability of at least one type specimen per basionym is found in the Supplementary File. In total, 78 basionyms were overlooked in at least one of the ten treatments where they should have been covered, plus the recently described *C. langaoensis* (Lu *et al.* 2017). We found 32 legitimate basionyms not included in the *World Checklist of Selected Plant Families* yet (WCSP 2016). The *World Checklist of Fagales* (Govaerts & Frodin 1998) missed 46 basionyms, plus three basionyms, *C. chingiana*, *C. fargesiana* var. *tchouana* and *C. henryana* var. *chuana* (Yang 1997). The latter might, however, have been published between the copy deadline and the publication of the checklist. Six relevant basionyms have been overlooked in the *Flora of USSR* (Bobrov 1936), ten in the *Flora of Japan* (Ohwi 1965), two in the *Flora of Taiwan* (Liao 1996), 34 in the *Flora Europaea* (Tutin & Walters 1993), three in the *Flora of North America* (Furlow 1997), 14 in the *Flora of China* (Li & Skvortsov 1999, including *C. chingiana*, *C. fargesiana* var. *tchouana* and *C. henryana* var. *chuana*), one in the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012), and three in the *Checklist of Korea* (Chang *et al.* 2014a). The four Chinese species *C. lipoensis*, *C. luochengensis*, *C. mengshanensis*, and *C. shimenensis* are accepted in the *World Checklist* (Govaerts & Frodin 1998), but not mentioned in the *Flora of China* (Li & Skvortsov 1999). The acceptance status of 21 names in *Carpinus* and one name in *Ostrya* differs among the different treatments. Five basionyms in *Carpinus* and one in *Ostrya* differ in the taxon to which the name is supposed to be synonymous only.

One hundred and two taxa of *Carpinus* and 16 of *Ostrya* (including all accepted ones) had original or type material available online, most of them freely. However, almost all herbaria surveyed *in situ* for type specimens and all herbaria with non-type digitization programs harbored hitherto unrecognized type material to a considerable degree. Complete digitization of herbaria, such as in the Paris herbarium, Naturalis or the China Virtual Herbarium, was most rewarding for this work, due to the manifold of unrecognized type material and the time-unlimited access.

Checklist of Carpinus

Order Fagales Engl.
Family Betulaceae Gray
Subfamily Coryloideae Hook.f.
Tribe Carpineae A.DC.

Carpinus L.

Species Plantarum: 998 (Linnaeus 1753). – *Ostrya* J.Hill, *The British Herbal*: 513 (Hill 1757) [“1756”] nom. rejic. – *C.* sect. *Eucarpinus* Sarg., *The Silva of North America* 9: 40 (Sargent 1896) nom. inval. [Art. 22.2, McNeill *et al.* (2012)]. – *C.* subg. *Eucarpinus* (Sarg.) Nakai, *The Botanical Magazine* [*Tokyo*] 29: 37 (Nakai 1915) nom. inval. [Art. 22.2, McNeill *et al.* (2012)]. – *C.* subg. *Carpinus* (L.) Hu, *Acta Phytotaxonomica Sinica* 9: 282 (Hu 1964). – *C.* ser. *Betulae* Hu, *Acta Phytotaxonomica Sinica* 9: 282 (Hu 1964), nom. inval. [Art. 22.2, 22.6, McNeill *et al.* (2012)]. – *C.* subsect. *Carpinus*

(L.) P.C.Li & S.H.Cheng, *Flora Reipublicae Popularis Sinicae* 21 (2): 65 (Li 1979a). – *C.* subsect. *Betulae* (Hu) C.J.Wang, *Flora Yunnanensis* 5: 182 (1991) nom. inval. [Art. 22.2, 22.6, McNeill *et al.* (2012)]. – Type species: *C. betulus* L., lectotypified by Britton & Brown (1913: 606).

Distegocarpus Siebold & Zucc., *Abhandlungen der Mathematisch-Physikalischen Klasse der Königlich Bayerischen Akademie der Wissenschaften* 4 (3): 226 (Siebold & Zuccharini 1846). – *Carpinus* sect. *Distegocarpus* (Siebold & Zucc.) Sarg., *The Silva of North America* 9: 40 (Sargent 1896). – *C.* subg. *Distegocarpus* (Siebold & Zucc.) Nakai, *The Botanical Magazine* [*Tokyo*] 29: 37 (Nakai 1915). – Type species: *Distegocarpus carpinus* Siebold & Zucc. (*C. japonica* Blume).

C. sect. *Brachyspicae* Nakai, *The Botanical Magazine* [*Tokyo*] 29: 37 (Nakai 1915). – Type species: *C. paxii* H.J.P.Winkl.

C. sect. *Elongatae* Nakai, *The Botanical Magazine* [*Tokyo*] 29: 37 (Nakai 1915). – Type species: Not designated.

C. ser. *Monbeigianae* Hu, *Acta Phytotaxonomica Sinica* 9: 285 (Hu 1964) [“Monberigianae”]. – *C.* subsect. *Monbeigianae* (Hu) P.C.Li, *Flora Reipublicae Popularis Sinicae* 21 (2): 70 (Li 1979a). – Type species: *C. monbeigiana* Hand.-Mazz.

C. ser. *Polyneurae* Hu, *Acta Phytotaxonomica Sinica* 9: 294 (Hu 1964). – *C.* subsect. *Polyneurae* (Hu) P.C.Li, *Flora Reipublicae Popularis Sinicae* 21 (2): 84 (Li 1979a). – Type species: *C. polyneura* Franch. [Art. 22.6, McNeill *et al.* (2012)].

C. ser. *Pubescentes* Hu, *Acta Phytotaxonomica Sinica* 9: 289 (Hu 1964). – Type species: *C. pubescens* Burkill [Art. 22.6, McNeill *et al.* (2012)].

C. subg. *Distegocarpus* ser. *Fangianae* Hu, *Acta Phytotaxonomica Sinica* 9: 281 (Hu 1964). – Type species: *C. fangiana* Hu.

C. subg. *Distegocarpus* ser. *Cordatae* Hu, *Acta Phytotaxonomica Sinica* 9: 282 (Hu 1964). – Type species: *C. cordata* Blume.

1. ***Carpinus betulus*** L.

Species Plantarum: 998 (Linnaeus 1753). – Original citation: “Europe, Canada.” – Type: Sweden, Småland, s. coll., s.n. (lecto-, designated by Browicz (1972: 3): LINN! ex herb. Linn. no. 1131.1). – Additional original material: Sweden, Skåne, *C. Linnaeus* s.n. (S09–40045).

C. vulgaris Mill., *The Gardeners Dictionary ed. 8*, no. 1 (Miller 1768). – Original citation: “In Germania copiose, rarius in Italia, in Scania & inferiore parte Smolandiae.” – Type: Dodoens (1616: 841) [figure]. – Additional original material: Sweden, Småland, s. coll., s.n. (LINN! ex herb. Linn. no. 1131.1). S. loc., s. coll., s.n. (BM000647417! ex herb. Cliff. no. 447).

C. sepium Lam., *Flore Françoise* 2: 212 (Lamarck 1779) nom. illegit. superfl. – Note: Lamarck (1779) cites *C. betulus* L. (Linnaeus 1763: 1416), which includes all citations for *C. betulus* L. (Linnaeus 1753).

C. compressus Gilib., *Exercitia Phytologica* 2: 399 (Gilibert 1792) nom. inval., opus utique oppr.

C. ulmifolia Salisb., *Prodromus Stirpium in Horto ad Chapel Allerton Vigentium*: 392 (Salisbury 1796) nom. illegit. superfl. – Note: Salisbury (1796) cites *C. betulus* L. (Linnaeus 1763: 1416), which includes all citations for *C. betulus* L. (Linnaeus 1753).

C. ulmoides Gray, *A Natural Arrangement of British Plants* 2: 245 (Gray 1821) nom. illegit. superfl. – Note: Gray (1821) cites *C. betulus* L. (Linnaeus 1763: 1416), which includes all citations for *C. betulus* L. (Linnaeus 1753).

C. austriaca M.Serres, *Voyage dans le Tyrol*: 320 (Serres 1823) nom. nud. – Original citation: “Les environs de Brixen [...], je distinguai le carpinus austriaca, tout-à-fait étranger à la Flore du Nord du Tyrol.” – Associated material: S.d. (P06810513!).

C. carpinizza Host, *Flora Austriaca* 2: 626 (Host 1831). – *C. betulus* [unranked] *carpinizza* (Host) Dippel, *Handbuch der Laubholzkunde* 2: 140 (Dippel 1891) [“1892”]. – *C. betulus* var. *carpinizza* (Host) C.K.Schneid., *Illustriertes Handbuch der Laubholzkunde* 1: 140 (Schneider 1904). –

C. betulus subsp. *carpinizza* (Host) O.Schwarz, *Mitteilungen der Thüringischen Botanischen Gesellschaft* 1: 96 (Schwarz 1949). – Original citation: "In sylvis Transylvaniae. Kitaibel. Fl. Majo. Incolae Transylvaniae, valachice loquentes, [...], et Carpinizza vocant." – Type: not localized (not in Kitaibel's herbarium in BP or in W). – Note: the application of this name is somewhat ambiguous. Host mentions in the description the 3-lobed bracts with smooth margins of the side lobes, typical for *C. betulus*. Neilreich (1861: 76), however, mentions that the name "carpinizza" is the vernacular Walachian name for *C. duinensis* Scop. (*C. orientalis* Mill.) and blames Kitaibel to whom Host refers for mixing that up. Then again, there is a *C. orientalis* specimen in Kitaibel's herbarium (XL/84!) with a label that this plant is called "Kárpánicza". It was therefore Host, not Kitaibel, misapplying the name. Schneider (1904) refers the rank variety to Neilreich (1861: 76), but Neilreich did not publish that combination. Therefore, Schneider's combination is the first at this rank.

C. betulus var. *integriloba* Spach, *Annales des sciences naturelles, Botanique ser. 2* 16: 252 (Spach 1841a). – Type: Ménagerie, 1833, s. coll., s.n. (lecto-, designated here: P06810518!). – Note: Spach did not cite any locality or specific specimen but this collection from Spach's herbarium bears a note "Nob." (ours).

C. betulus var. *odontoloba* Spach, *Annales des sciences naturelles, Botanique ser. 2* 16: 252 (Spach 1841a). – Original citation: No detailed data given. – Type: not localized.

C. betulus f. *serrata* Schur nom. nud. in sched., non Beck (Beck von Mannagetta 1890). – Associated material: Romania, Siebenbürgen, Bergregion bis 3000', 1848, *P.J.F. Schur 14164* (P06747296!). Romania, Siebenbürgen, Hermannstadt [Sibiu], 1848, *P.J.F. Schur 14166* (P06747370!). – Note: this name is only known from two specimens, but Schur published many taxa, and this name might have been published. Should Schur's name have been validly published before 1904, then it would have priority over *C. betulus* var. *serrata* (Beck) C.K.Schneid. (*C. betulus* [unranked] *serrata* Beck, basion.).

C. intermedia Wierz. ex Rchb., *Icones Florae Germanicae et Helveticae* 12: 4, pl. DCXXXIII (Reichenbach 1850). – Original citation: "in Bannatu, am Wege von der Sägemühle gegen Kirscharusch bei Steyersdorf [Anina in Caraș-Severin], [P.P]. Wierzbicki!". – Type: not localized.

C. betulus var. *provincialis* Gren. & Godr., *Flore de France* 3 (1): 121 (Grenier & Godron 1855). – *C. provincialis* J.Gay nom. nud. in sched. – Original citation: "Forêts, bois et taillis." – Type: France [Provence-Alpes-Côte d'Azur: Var], Pennafort près Draguignan, Jun. 1830, *J.H. Perreymond 28* (lecto-, designated here: K!). – Additional original material: France, Draguignan, *J.H. Perreymond* s.n. (K!); ibid., 1840, *J.H. Perreymond* s.n. (P00543785!). – Note: the specimen here designated as lectotype is mounted with the original note of Gay from 1835, where he describes his new species *C. provincialis*. In a note from 1 Dec. 1853 —also attached to the sheet— announcing a letter to Grenier for the following day, Gay rejects his species as a youthful folly ("péché de ma jeunesse"). Nevertheless, Grenier took up the name and published is as a variety in his *Flore de France*.

C. betulus var. *obtusifolia* G.Kirchn., *Arboretum Muscaviense*: 667 (Petzold & Kirchner 1864). – *C. betulus* f. *obtusifolia* (G.Kirchn.) H.J.P.Winkl., *Das Pflanzenreich* IV 61 (Heft 19): 30 (Winkler 1904). – Original citation: No detailed data given. – Type: not localized. – Note: Petzold & Kirchner accepted their term "Spielart" in the sense of "varietas" as only rank below the species (1864: 41). Although they discuss other rank-denoting terms, such as "Unter-Art" (subspecies) and "Form" (forma) as being widely used, they only accept "Spielarten". Hence, names below the species rank in Petzold & Kirchner (1864) are to be treated as varieties.

C. subcordifolia Schur, *Enumeratio Plantarum Transsilvaniae*: 611 (Schur 1866). – Original citation: "In Wäldern der Kalkgebirge: auf dem Ecsem-Teteje bei Sz. – Domokos; auf dem Kereszthegy bei Remete. Jul." – Type: not localized. – Note: this name is missing in all relevant treatments and current databases surveyed.

C. nervata Dulac, *Flore du Département des Hautes-Pyrénées*: 141 (Dulac 1867). – Type: France, Hautes-Pyrénées, Lascazères, *J.J. Corbin* s.n. (syn-: BBF?); ibid., Saint-Sever-de-Rustan, *J.J. Corbin* s.n. (syn-: BBF?).

C. ulmifolia St.-Lag., *Études des Fleurs ed. 8*, 2: 742 (Cariot 1889) nom. illegit. superfl. – Note: Saint-Lager proposed this name to replace *C. betulus* L.

C. betulus var. *haynaldiana* Borbás, *Oesterreichische Botanische Zeitschrift* 39 (6): 234 (Braun 1889). – Original citation: "Im Auwinkel [Zugliget] bei Ofen [Buda]." – Type: Hungary [Közép-Magyarország], in silvaticis ad Zugliget (Auwinkel) Budae-Pestini, 15 Jul. 1888, *V. de Borbás* s.n. (syn-: BM!); ibid., 27 Jul. 1888, *V. de Borbás* s.n. (syn-: E!). – Note: this name is missing in all relevant treatments and current databases surveyed.

C. betulus [unranked] *serrata* Beck, *Flora von Nieder-Österreich*: 266 (Beck von Mannagetta 1890). – *C. betulus* var. *serrata* (Beck) C.K.Schneid., *Illustriertes Handbuch der Laubholzkunde* 1: 140 (Schneider 1904). – *C. betulus* subsp. *serrata* (Beck) O.Schwarz, *Mitteilungen der Thüringischen Botanischen Gesellschaft* 1: 96 (Schwarz 1949). – *C. betulus* f. *serrata* (Beck) Georgescu, *Flora Republicii Populare Române* 1: 195 (Săvulescu 1952). – Original citation: No detailed data given. – Type: not localized.

C. betulus var. *typica* Koehne, *Deutsche Dendrologie*: 193 (Koehne 1893) nom. inval. [Art. 24.3; McNeill *et al.* (2012)].

C. betulus var. *angustifolia* Błocki ex Zapał., *Conspectus Florae Galiciae Criticus* 2: 9 (Zapałowicz 1908). – Original citation: "Lesienice pod Lwowem (Błocki), Strzyżów w Jasielskiem (Holzer)." – Type: [Ukraine, Lviv] Lesienice bei Lemberg, 1886, *B. Błocki* s.n. (syn-: not localized; isosyn-: B!, P06747360!, P06747390!, P06809764!, W1985–5965!); [Poland, Województwo podkarpackie] Jasielski, Strzyżów, *Holzer* s.n. (syn-: not localized).

C. betulus [unranked] *angustifolia* Medw., *Vestnik Tiflisskogo Botanicheskogo Sada* 14: 26 (Medwedew 1909) nom. illegit. (later homonym). – *C. betulus* var. *angustifolia* (Medw.) Radde-Fom., *Trudy fizychno-matematychnogo viddilu. Kiev* [*Mémoires de la Classe des Sciences Physiques et Mathématiques de l'Académie des Sciences de l'Ukraine*] 15 (1): 80 (Radde-Fomina 1929) nom. illegit. (later homonym). – *C. betulus* f. *angustifolia* (Medw.) Radde-Fom., *Trudy fizychno-matematychnogo viddilu. Kiev* [*Mémoires de la Classe des Sciences Physiques et Mathématiques de l'Académie des Sciences de l'Ukraine*] 15 (1): 80 (Radde-Fomina 1929) nom. inval. pro syn. – Original citation: "найдена въ верхней Аджаріи (ущ. р. Аджарисъ-цкали въ Батумской обл.) ло Годерзскаго перевала и за нимъ (въ бассейнѣ Куры, Масальскій, герб. Спб. Бот. Сада) а также въ Терской области на хр. Салатау, между с. Чиркей и Хонцагой, на высотѣ 3000' (Алекс., герб. Ак. Н.)" [Found in Upper Adsharia (Acharis-Tskali river in Batumi province), at Goderdzi Pass and beyond (in Kura basin; Massalsky, Herb. of the St. Petersburg Botanical Garden). In Terek region, in Salatau between Czirkei and Honzagoi, alt. 3000' (Alexeenko, Herb. of the Academy).]. – Type: not localized. – Note: Medwedew differentiated three forms of *C. betulus* in the Caucasus, but published his *C. betulus* [unranked] *angustifolia* explicitly as "var. nov." Nowadays, the use of the two different ranks in a non-successive order is to be interpreted as unranked (Art. 37.8; McNeill *et al.* 2012). Radde-Fomina (1929: 80) accepted Medwedew's informal use of "form" and cited Medwedew's name in the rank forma and gave it the rank as variety afterward, while citing Medwedew's form in the synonymy. Irrespective of this, Medwedew's and Radde-Fomina's names are illegitimate due to the priority of Zapałowicz's name from 1908.

C. betulus var. *acuminata* K.Reinecke, *Mitteilungen des Thüringischen Botanischen Vereins* 28: 41 (Reinecke 1911). – Original citation: "Im Glacis der Cyriaksburg b. E. [Erfurt, Germany]." – Type: not localized.

C. betulus var. *parva* Radde-Fom., *Trudy fizychno-matematychnogo viddilu. Kiev* [*Mémoires de la Classe des Sciences Physiques et Mathématiques de l'Académie des Sciences de l'Ukraine*] 15 (1): 55, tab. VI f, g, e (Radde-Fomina 1929). – Original citation: "Dagestan, Agan-Kale prope Temir-chan-Schura [former name of Buynaksk] 2. X. 1916. Budaev [s.n.]!". – Type: not localized.

C. betulus f. *subacuta* Domin, *Flora Čechoslovenica Exsiccata* no. 245 (1931) in sched. – Type: Czech Republic, Bohemia centralis, gregarie in valle Radotinské údoli prope urbem Praha, solo calcareo, altitudine circa 250 m a.s.l., 10 Aug. 1931, *K. Domin* and *M. Deyl* s.n. (holo-: not localized; iso-: B10

0752246!, B!, B!, K!, MSB-114979!). – Note: this name is effectively published on specimen labels accompanying the types (Art. 30.7; McNeill *et al.* 2012).

C. betulus var. *tuzsoni* Kárp., *Botanikai Közlemények* 34: 195 (Kárpáti 1937). – Original citation: "Während einer Excursion unter der Leitung des Herrn Prof. Dr. J. v. Tuzson machten wir am Jánoshegy bei Budapest […].". – Type: not localized. – Note: this is a variety with fissured bark.

C. caucasica Grossh., *Izvestiya Azerbaidzhanskogo Filiala* [*Akademii Nauk SSSR*] 1940 (5): 34 (Grossheim 1940). – Type: [Russia] Sala-tau, Czirkei × Honzagoi, ± 3000 ft, 28 Jul. 1897, *T. Alexeenko* s.n. (holo-: LE). – Note: the holotype might be the same specimen as the one cited as syntype of *C. betulus* [unranked] *angustifolia* Medw.

1a. ***Carpinus betulus*** '**Quercifolia**'

C. betulus var. *quercifolia* hort. ex C.F.Ludw. (Ludwig 1783). – *C. quercifolia* (C.F.Ludw.) Desf., *Tableau de l'École de Botanique*: 213 (Desfontaines 1804). – *C. betulus* f. *quercifolia* hort. ex K.Koch, *Dendrologie* 2, 2: 3 (Koch 1873) nom. inval. pro syn. – *C. betulus* f. *quercifolia* (C.F.Ludw.) C.K.Schneid., *Illustriertes Handbuch der Laubholzkunde* 1: 140 (Schneider 1904). – *C. betulus* var. *quercifolia* (Desf.) Tzvelev, *Flora Vostochnoĭ Evropy* 11: 91 (Tzvelev 2004) nom. illegit. (later homonym). – Original citation: not localized. – Type: Paris Botanical Garden [cult.], s. coll., s.n. (neo-, designated here: P06747373!). – Note: the oak-leaved hornbeam is an early mentioned cultivar that is usually attributed to Desfontaines (1804: 213). However, the mutation was known before 1783 when Ludwig published an oak-leaved, *C. betulus* var. *quercifolia*. The short description by Ludwig (1783) was actually the English name, under which it was supposedly sold in an English garden catalogue. Ludwig (1783) cites four English catalogues in the preface and mentions that he did not translate any name himself. The name 'Quercifolia' does not appear in the Loddiges catalogues (Loddiges 1779, 1783), while the remaining two could not be examined by the present authors. Therefore, it might be possible that the name was published validly even before. As all treatments deal with the same taxon, Art. 41.4 (McNeill *et al.* 2012), applies. The specimen chosen as neotype is likely to represent what was and still is understood under this name. The end of the left branch on the neotype has strong affinities to the cultivar 'Incisa', showing that these two may not always be readily distinguished. Already Koch (1873) considered the two names as the same. However, for now, it deems the present authors best to keep these two names separate.

C. betulus var. *heterophylla* hort. ex Loudon, *Arboretum et Fruticetum Britannicum* 3: 2005 (Loudon 1838) nom. inval. pro syn. – Note: this cultivar with an unusual leaf incision is sometimes regarded as the same as 'Incisa', but in contrast to 'Incisa' with acute lobes and shallow teeth, the ones in 'Quercifolia' are rather obtuse and rounded (cf. Nicholson 1883; Schneider 1904). Koch regarded *C. betulus* 'Quercifolia' as synonymous to 'Incisa' and published the epithet as *C. betulus* f. *incisa* (Aiton) K.Koch (*C. betulus* var. *incisa* Aiton, basion.).

1b. ***Carpinus betulus*** '**Incisa**'

C. betulus var. *incisa* Aiton, *Hortus Kewensis* 3: 362 (Aiton 1789). – *C. betulus* f. *incisa* (Aiton) K.Koch, *Dendrologie* 2, 2: 3 (Koch 1873). – Type: Kew [cult.], Oct. 1883, s. coll., s.n. (neo-, designated here: K! ex ligneous herb. Mr. G. Nicholson s.n.). – Note: the specimen designated as neotype here is mounted together with another specimen marked as "*C. betulus* var. *asplenifolia*".

C. laciniata hort. ex G.Nicholson, *The Garden* (*London 1871–1927*) 24: 419 (Nicholson 1883) nom. inval. pro syn. – Note: this variety, better to be treated as a cultivar, has leaves with a lobulate margin, triangular lobes, acute apices, and a shallow dentation.

1c. ***Carpinus betulus*** '**Variegata**'

C. betulus var. *variegata* Lodd. ex Loudon, *Arboretum et Fruticetum Britannicum* 3: 2005 (Loudon 1838). – *C. betulus* f. *variegata* (Lodd. ex Loudon) H.J.P.Winkl., *Das Pflanzenreich* IV 61 (Heft 19): 31 (Winkler 1904). – Original citation: No detailed data given. – Type: not localized. – Note: this is a cultivar with variegated leaves from Loddiges' plant catalogue (Loddiges 1836). Winkler cites neither Loudon nor Loddiges (1836) but Dippel (1891: 140), and according to Art. 41.4. (McNeill *et al.* 2012), his name should be considered as a new combination as he is dealing with the same cultivar. The color of the variegation is unknown, as Loudon does not mention it. Dippel (1891: 149) recognizes only a single variegated cultivar, irrespective from the color of the variegation, while Schneider (1904) recognizes a forma *albovariegata* and a forma *aureovariegata*.

1d. ***Carpinus betulus*** '**Heterophylla**'

C. betulus var. *heterophylla* G.Kirchn., *Arboretum Muscaviense*: 667 (Petzold & Kirchner 1864). – *C. betulus* f. *heterophylla* (G.Kirchn.) K.Koch, *Dendrologie* 2 (2): 3 (Koch 1873). – Original citation: No detailed data given. – Type: not localized. – Note: Kirchner gave the name "*heterophylla*" to plants that have both normal-shaped leaves and deeply serrated leaves, regardless whether the leaf serration is of the 'Incisa' or 'Quercifolia' type, which he regarded as synonymous, as did Koch. As the mutation occurs spontaneously and may be fixed by cuttings, this name 'Heterophylla' is complicated to use. Kirchner refers to "Bth. cat.", meaning the catalogue of James Booth and Söhne nursery in Klein-Flottbek, Hamburg, Germany. As there is no reference to Loudon, Kirchner's name cannot be regarded as a clear recombination of *C. betulus* var. *heterophylla* hort. ex Loudon, which is an invalid name published as a synonym of *C. betulus* 'Quercifolia'. Therefore, Kirchner's name is not illegitimate, but rather a later homonym.

1e. ***Carpinus betulus*** '**Pendula**'

C. [unranked] *pendula* Massé, *Revue Horticole ser. 4* 2: 271 (Massé 1853). – *C. betulu*s var. *pendula* (Massé) G.Kirchn., *Arboretum Muscaviense*: 667 (Petzold & Kirchner 1864). – *C. pendula* (Massé) K.Koch, *Dendrologie* 2 (2): 3 (Koch 1873). – *C. betulus* f. *pendula* (Massé) Schelle, *Handbuch der Laubholzbenennung*: 48 (Beissner *et al.* 1903). – Original citation: No detailed data given. – Type: not localized. – Note: this is a cultivar with weak, overhanging branches. Massé mentions a "*Carpinus pendula*" but immediately called it a variety of the common hornbeam. Therefore, the taxonomic status is unclear upon publication, and the name is to be treated as unranked. Although neither Koch nor Beissner *et al.* (1903) explicitly refer to Massé, the names are to be regarded as a new combination (Art. 41.4; McNeill *et al.* 2012).

1f. ***Carpinus betulus*** '**Purpurea**'

C. betulus f. *purpurea* K.Koch, *Dendrologie* 2 (2): 3 (Koch 1873). – *C. betulus* var. *purpurea* (K.Koch) G.Nicholson, *The Garden* (*London 1871–1927*) 24: 419 (Nicholson 1883). – Original citation: No detailed data given. – Type: not localized. – Note: this is a cultivar with initially brownish-red leaves that turn greenish soon after. Nicholson does not refer to Koch, but intended to describe the same cultivar, therefore Art. 41.4 (McNeill *et al.* 2012) applies.

1g. ***Carpinus betulus*** '**Fastigiata**'

C. betulus var. *fastigiata* hort. ex G.Nicholson, *The Garden* (*London 1871–1927*) 24: 419 (Nicholson 1883). – *C. betulus* f. *fastigiata* (G.Nicholson) Schelle, *Handbuch der Laubholzbenennung*: 48 (Beissner *et al.* 1903). – Original citation: No detailed data given. – Type: not localized. – Note: the

branches of this cultivar are supposed to be "more ascending and the habit altogether more erect." Beissner *et al.* (1903) do not refer to Nicholson, but basically describe the same cultivar, therefore Art. 41.4 (McNeill *et al.* 2012) applies.

C. betulus [unranked] *pyramidalis* Dippel, *Handbuch der Laubholzkunde* 2: 140 (Dippel 1891) ["1892"] nom. illegit. superfl. – *C. betulus* f. *pyramidalis* (Dippel) H.J.P.Winkl., *Das Pflanzenreich* IV 61 (Heft 19): 31 (Winkler 1904) nom. illegit. superfl. – Note: Dippel (1891) and Winkler (1904) both cite *C. betulus* 'Fastigiata' as a synonym, therefore their names are superfluous.

1h. ***Carpinus betulus*** '**Columnaris**'

C. betulus [unranked] *columnaris* Beissn., *Mitteilungen der Deutschen dendrologischen Gesellschaft* 8: 136 (Beissner 1899b). – *C. betulus* f. *columnaris* (Beissn.) Schelle, *Handbuch der Laubholzbenennung*: 48 (Beissner *et al.* 1903). – *C. betulus* var. *columnaris* (Beissn.) Bean, *Trees and Shrubs, Hardy in the British Isles* 1: 294 (Bean 1914). – Original citation: "In the gardens of Fürst Lobkowitz [Ferdinand Zdenko von Lobkowitz] at Schloss Eisenberg [Jezeří Castle, Czech Republic]". – Type: not localized. – Note: according to Beissner *et al.* (1903), this cultivar was reported for the first time in a garden catalogue of the *Späth'sche Baumschule* in Berlin, Germany, in 1891, but the present authors could not verify if that publication contains a valid description. Although neither Beissner *et al.* (1903) nor Bean (1914) refer to Beissner (1899b), they all refer to a cultivar with erect branches forming a slender crown, so their names can be considered as new combinations (Art. 41.4.; McNeill *et al.* 2012).

1i. ***Carpinus betulus*** '**Pyramidalis**'

C. betulus var. *pyramidalis* hort. ex Bean, *Trees and Shrubs, Hardy in the British Isles* 1: 294 (Bean 1914). – Original citation: "A fine specimen grows in the Solferino Square at Rouen.". – Type: not localized. – Note: this cultivar has erect branches, but not as slender as those of 'Columnaris'. Bean does not refer to Dippel (1891) or Winkler (1904), whose names are superfluous.

1j. ***Carpinus betulus*** '**Fastigiata Cucullata**'

C. betulus f. *cucullata* hort. ex H.J.P.Winkl., *Das Pflanzenreich* IV 61 (Heft 19): 31 (Winkler 1904). – *C. betulus fastigiata cucullata* G.Kirchn., *Arboretum Muscaviense*: 667 (Petzold & Kirchner 1864) nom. inval. [polynomen as it was not published hyphenated, cf. Art. 20.3, Ex.7, McNeill *et al.* (2012)]. – Original citation: No detailed data given. – Type: not localized. – Note: this is a garden cultivar with pyramidal growth and hooded leaves. The cultivar name 'Fastigiata Cucullata' is the earliest available one (Art. 21.6; Brickell *et al.* 2009), although not valid under the botanical Code (Art. 23.6c; McNeill *et al.* 2012), under which it was independently published as *C. betulus* f. *cucullata* by Winkler (1904).

1k. ***Carpinus betulus*** '**Albovariegata**'

C. betulus f. *albovariegata* C.K.Schneid., *Illustriertes Handbuch der Laubholzkunde* 1: 140 (Schneider 1904). – Original citation: No detailed data given. – Type: not localized. – Note: it was published as "*albo-variegata*", corrected according to Art. 60.9 (McNeill *et al.* 2012).

1l. ***Carpinus betulus*** '**Aureovariegata**'

C. betulus f. *aureovariegata* C.K.Schneid., *Illustriertes Handbuch der Laubholzkunde* 1: 140 (Schneider 1904). – Original citation: No detailed data given. – Type: not localized. – Note: it was published as "*aureo-variegata*", corrected according to Art. 60.9 (McNeill *et al.* 2012).

1m. ***Carpinus betulus*** '**Horizontalis**'

C. betulus [unknown rank] *horizontalis* Simon-Louis, "*Preisverw., Herbst" 1902–1903* (Simon-Louis 1902). – *C. betulus* f. *horizontalis* (Simon-Louis) C.K.Schneid., *Illustriertes Handbuch der Laubholzkunde* 1: 140 (Schneider 1904) – *C. betulus* var. *horizontalis* (Simon-Louis) Bean, *Trees and Shrubs, Hardy in the British Isles* 1: 294 (Bean 1914). – Original citation: No detailed data given [found by M. Jouin on the Simon-Louis establishments near Metz, France (Bean 1914)]. – Type: not localized. – Note: this is a cultivar with a flat crown. The present authors do not have the Simon-Louis catalogue at hand. Depending on whether or not it contains a description and a definite rank, Schneider's name would become valid when he provided both. If the publication by Simon-Louis constitutes a valid publication with a definite rank, either Schneider's or Bean's combination might become superfluous.

1n. ***Carpinus betulus*** '**Asplenifolia**'

C. betulus var. *asplenifolia* Bean, *Trees and Shrubs, Hardy in the British Isles* 1: 294 (Bean 1914). – Original citation: No detailed data given. – Type: not localized. – Note: cultivar with incised leaves. The incision depth is described as "the primary teeth large enough to be termed lobes".

2. ***Carpinus caroliniana*** Walter

Flora Caroliniana: 236 (Walter 1788). – Original citation: No detailed data given. – Type: not localized.
C. ostryoides Raf., *The Medical Repository ser. 3* 2: 333 (Rafinesque 1811) nom. nud., non Göppert (1855). – Note: Göppert's *C. ostryoides* is a valid name for a leaf fossil without reference to Rafinesque (1811).

2a. ***Carpinus caroliniana*** Walter subsp. ***caroliniana***

Note: It was accepted as subspecies distinct from *C. caroliniana* subsp. *virginiana* (Marshall) Furlow in the *Flora of North America* (Furlow 1997).
C. americana Michx., *Flora Boreali-Americana* 2: 201, pl. 7 (Michaux 1803). – Original citation: "A Canadam ad Floridam." – Original material: Ameriques septentrionales, *A. Michaux* s.n. (P06810890!); ibid., s. coll., s.n. (P06810902!, P06810903!). – Note: *Carpinus americana* is regarded as synonymous to *C. caroliniana* s. lat. in *Flora of North America* (Furlow 1997).

2b. ***Carpinus caroliniana*** subsp. ***virginiana*** (Marshall) Furlow

Systematic Botany 12: 429 (Furlow 1987). – *C. betulus* var. *virginiana* Marshall, *Arbustrum Americanum*: 25 (Marshall 1785). – *C. virginiana* (Marshall) Sudworth, *Bulletin of the Torrey Botanical Club* 20: 43 (Sudworth 1893) nom. illegit., non Miller (1768). – *C. caroliniana* var. *virginiana* (Marshall) Fernald, *Rhodora* 37: 425 (Fernald 1935). – Type: s. loc., 16 Sep. 1906, *R.W. Woodward* s.n. (neo- , designated by Furlow (1987: 429): NEBC00078970!). – Note: original material in Marshall Herbarium, but it was destroyed (Furlow 1987).

3. ***Carpinus chingiana*** C.C.Yang

Distribution of the Woody Plants in Sichuan [四川树木分布]: 661 (Yang 1997). – Type (according to *IPNI*): China, Sichuan, Muli, 2600 m a.s.l., 3 Aug. 1978, *Q.-S. Zhao et al.* [*Zhao Zhenju, Mu Ke-hua, Yang Yabin*/赵清盛, 牟克华, 杨亚滨] *6980* (holo-: SZ00094298, SZ00094299; iso-: CDBI0172181!, CDBI0172182!, CDBI0172183!). – Note: this name is accepted in the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012), but neither listed in the *World Checklist* (Govaerts & Frodin

1998) nor in the *Flora of China* (Li & Skvortsov 1999). The CDBI specimens were labeled by Yang as "*Carpinus chingii*", and the specimen CDBI0172182 bears an annotation slip by Yang with the unpublished name "*Carpinus muliensis*".

4. ***Carpinus chuniana*** Hu

Journal of the Arnold Arboretum 13: 334 (Hu 1932). – Type: China, Kwangtung [Guangdong], Lokchang, 31 May 1929, *C.L. Tso* [左景烈] *20872* (holo-: PE?; iso-: A00033751!, IBSC0001142, IBSC0001143, IBSC0001144, NY00253858!).

5. ***Carpinus cordata*** Blume

Museum Botanicum Lugduno-Batavum 1 (20): 309 (Blume 1851). – Original citation: "Fisibami japonice. In Japoniâ a Cl. Viro von Siebold detecta." – Type: Japan, in Japoniâ, s. coll., s.n. (lecto-, designated here: L0040896! ex herb. Siebold s.n.; isolecto-?: L0103212).

5a. ***Carpinus cordata*** Blume var. ***cordata***

C. erosa Blume, *Museum Botanicum Lugduno-Batavum* 1 (20): 308 (Blume 1851). – Original citation: "In Japoniâ." – Type: Japan, s. coll. (lecto-, designated here: L0040895! ex herb. Siebold s.n.).

C. erosa var. *microcarpa* Hayashi, 林業試験場研究報告 [*Research Report of the Forestry Experiment Station*] 57: 153 (Hayashi 1952). – Type: Japan, Ezo [Hokkaido], Prov. Hiyama, Mt. Gamushi, 8 Aug. 1952, *Y. Hayashi* s.n. (holo-: TFM).

C. erosa var. *velutina* Hayashi, 林業試験場研究報告 [*Research Report of the Forestry Experiment Station*] 57: 153 (Hayashi 1955). – Type: Japan, Hondo, Prov. Rikuchiu, Yamagata in Kuji, 15 Aug. 1952, *N. Karizumi* s.n. (holo-: TFM).

Ostrya mandshurica Budischtschew ex Trautv., *Trudy Imperatorskago S.-Peterburgskago Botaniceskago Sada* 9: 166 (Trautvetter 1884). – Type: not localized, likely in LE.

C. cordata var. *pseudojaponica* H.J.P.Winkl., *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 50 (Suppl.): 490 (Winkler 1914). – *C. erosa* var. *pseudojaponica* Miyabe & Tatewaki, *Bulletin of the Kyushu University Forests* 21: 48 (Tatewaki 1953) nom. inval. – *C. erosa* var. *pseudojaponica* (H.J.P.Winkl.) Miyabe & Kudo ex Horikawa, *Acta Phytotaxonomica et Geobotanica* 15 (1): 13 (Horikawa 1953) nom. inval. pro syn. – Type: Japan, Insel Yesso, Mororan, Sep. 1904, *U.J. Faurie 5775b* (holo-: B†) [on *U.J. Faurie 5775* in B marked with *b*]. – Note: this name is not mentioned in the *World Checklist* (Govaerts & Frodin 1998) or in the WCSP (2016), but it is synonymized under *C. cordata* in the *Flora of Japan* (Ohwi 1965). Tatewaki published the combination without reference to older literature or an own description, it is therefore invalid (Art. 41.3; McNeill *et al.* 2012). Horikawa referred to the combination as *C. erosa* var. *pseudojaponica* (H.J.P.Winkl.) Miyabe & Kudo in synonymy only. The combination may have been published in *Icones of the essential forest trees of Hokkaido* (Miyabe *et al.* 1920–1932) though, but the present authors did not have access for verification

C. cordata var. *faurieana* H.J.P.Winkl., *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 50 (Suppl.): 489 (Winkler 1914). – Type: Japan, Insel Yesso, Sapporo, Jun. 1891, *U.J. Faurie 7111* (lecto-, designated here: P06747141!). – Additional type material: Japan, Iwanai, Sep. 1904, *U.J. Faurie 5777* (syn-: A00033752!, BM000580426!). – Note: this name is not mentioned in the *World Checklist* (Govaerts & Frodin 1998) or the WCSP (2016). Based on the subglabrous leaves and the locus classicus being on Hokkaido, it may well represent a distinct taxon.

C. cordata var. *robusta* H.J.P.Winkl., *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 50 (Suppl.): 489 (Winkler 1914). – Type: Japan, Insel Yesso, Mororan, Sep. 1904, *U.J. Faurie 5775* (syn-: BM000580424!, E!). – Note: this name is not mentioned in the *World Checklist* (Govaerts & Frodin 1998) or the WCSP (2016). As for *C. cordata* var. *faurieana*

H.J.P.Winkl. it is unlikely that this name is synonymous with the other accepted varieties because of the relatively subglabrous nature and the *locus classicus* being on Hokkaido instead of the Asian mainland.

C. cordata var. *winkleri* Radde-Fom., *Trudy fizychno-matematychnogo viddilu. Kiev* [*Mémoires de la Classe des Sciences Physiques et Mathématiques de l'Académie des Sciences de l'Ukraine*] 15 (1): 70 (Radde-Fomina 1929). – Original citation: "Wladiwostok 1864 *Budischczev* [s.n.]! «Suchaja Padi» in viciniis pag. Rakovka 2. IX. 1915, Neczajeva et Gordeev! Orlinoe Gnieso ad marginem sylvae 17. V. 1907. *Palczevsky* [s.n.]! Prov Primorskaja, flum Orlinoje Gniesdo IX. 1902 *Palczevsky* [s.n.]!". – Type: not localized.

C. cordata var. *brevistachyus* S.L.Tung, *Bulletin of Botanical Research, Harbin* 1 (1–2): 139 (Tung 1981). – Type: China, Jilin, Linjiang [临江], 700 m a.s.l., 22 Jun. 1962, *Y.L. Chou* [周以良] *60007* (holo-: NEFI).

5b. ***Carpinus cordata*** var. ***chinensis*** Franch.

Journal de Botanique [*Morot*] 13: 202 (Franchet 1899). – *C. cordata* f. *chinensis* (Franch.) Nakai, *The Journal of the College of Science, Imperial University of Tokyo, Japan* 31: 205 (Nakai 1911). – *C. chinensis* (Franch.) C.Pei, *Botanical Bulletin of Academia Sinica* 2: 223 (Pei 1948). – Type: China, Sutchuen [Sichuan], in ditione Tchen keou tin [Chengkou County], 1400 m a.s.l., *P.G.* (*Reverend Père*) *Farges 14* (lecto-, designated here: P06747063!; isolecto-: L!, P06747058!, P06747059!, P06747060!). – Note: *Carpinus cordata* var. *chinensis* is accepted in the *Flora of China* (Li & Skvortsov 1999), but it is segregated as *C. chinensis* in the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012).

5c. ***Carpinus cordata*** var. ***mollis*** (Rehder) W.C.Cheng ex Y.Chen

Illustrated Manual of Chinese Trees and Shrubs: 163 (Chen 1937). – *C. mollis* Rehder, *Journal of the Arnold Arboretum* 11: 154 (Rehder 1930). – Type: China, Sichuan, Sungpan hsien, side of stream, 17 Aug. 1928, *W.P. Fang* [方文培] *4245* (holo-: A00033760!; iso-: E00275495!, E00275496!, K000859923!, NAS00070300, NY00253865!, P01903243!, PE00021928!, PE00021929!). – Note: *Carpinus cordata* var. *mollis* is accepted in *Flora of China* (Li & Skvortsov 1999), but it is regarded as a synonym of *C. chinensis* in the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012).

6. ***Carpinus dayongina*** K.W.Liu & Q.Z.Lin

Bulletin of Botanical Research, Harbin 6 (2): 143 (Liu & Lin 1986). – Type: China, Hunan, Dayong [now Zhangjiajie], Tianmen shan, 1100 m a.s.l., 28 Jul. 1985, *K.W. Liu* [*Liu Ke-wang*] *33359* (holo-: CSFI; iso-: PE). – Additional type material: ibid., 25 Aug. 1984, *Y.T. Xiao* [*Xiao Yu-tan*] *40700* (para-: not localized). – Note: the epithet is sometimes cited as "*dayongiana*" (Govaerts & Frodin 1998; WCSP 2016), but the authors consistently use "*dayongina*" (Liu & Lin 1986: 143, 145), and correctly so (Art. 60 Rec. 60D, McNeill *et al.* 2012).

7. ***Carpinus faginea*** Lindl.

Plantae Asiaticae Rariores 2: 50 (Wallich 1831). – Type: India [Uttar Pradesh], Gurwal, *Kamrup* [*Kamroop*] s.n. (holo-: CGE?).

C. latibracteata Lindl. nom. nud. in sched. – Note: this name is only known from one specimen. It also bears the notes "Wallich H.I." and "Lindley 1830", however, neither Wallich nor Lindley were in Kumaon in 1830. Likely, it is material from Wallich's collection (by Robert Blinkworth?), and the name was written onto the specimen by Lindley in 1830 [India, Kamaon [Kumaon], s. coll., s.n. (K!)], but never published.

8. ***Carpinus fangiana*** Hu

Journal of the Arnold Arboretum 10: 154 (Hu 1929). – Type: China, Sichuan, Nanchuan Hsien, in thickets, 1500–1800 m a.s.l., 1 Jun. 1928, *W.P. Fang* [方文培] *1351* (lecto-, designated by Lin *et al.* (2007: 1248): PE00021890; isolecto-: A00033753!, E00275500!, E00275501!, IBSC0367917, K000859928!, NY00253860!, P06747103!, PE00021891!, PE00021968!). – Additional type material: ibid., *W.P. Fang 1352* (para-: E!, IBSC0367916, K!, P06747102! PE00021888!, PE00021969!). – Note: accepted in the *Flora of China* (Li & Skvortsov 1999), in the *World Checklist* (Govaerts & Frodin 1998), and in the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012).

C. wilsoniana Hu, *Journal of the Arnold Arboretum* 10: 154 (Hu 1929). – Type: China, Sichuan, Mt. Omei, in thickets, 1675–1800 m a.s.l., 9 Aug. 1928, *W.P. Fang 2685* (lecto-, designated here: PE00021889; isolecto-: A00033772!, E00275499!, E00275528!, IBSC0367915, K000859919!, NAS00070302!, NY00253869!, P06810764!, PE00021970!).

9. ***Carpinus fargesiana*** H.J.P.Winkl.

Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie 50 (Suppl.): 507 (Winkler 1914). – Type: China, Sutchuen [Sichuan], in ditione Tchen keou tin [Chengkou County] [as "*Carpinus yedoensis*"], *P.G.* (*Reverend Père*) *Farges* s.n. (lecto-, designated here: P06811425!; isolecto-: P06811420!). – Additional type material: China, Sichuan, *A. Henry 7053* (syn-: not localized).

9a. ***Carpinus fargesiana*** H.J.P.Winkl. var. ***fargesiana***

Note: It was accepted with *C. fargesiana* var. *hwai* (see *C. fargesiana* var. *ovalifolia*) as another variety of *C. fargesiana* in the *Flora of China* (Li & Skvortsov 1999).

C. daginensis Hu, *Acta Phytotaxonomica Sinica* 9: 293 (Hu 1964). – Type: China, Sichuan, Dagin Hsien, Aning, 2900 m a.s.l., 9 May 1958, *X. Li* [*Li Hsien,* 李馨] *77351* (holo-: PE00021885!; iso-: NAS00070301, WUK0252019). – Note: *Carpinus daginensis* is considered as a synonym of *C. fargesiana* var. *fargesiana* in the *Flora of China* (Li & Skvortsov 1999) and in the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012: 35).

C. fargesiana var. *tchouana* C.C.Yang, *Distribution of the Woody Plants in Sichuan* [四川树木分布]: 662 (Yang 1997). – Type: not localized. – Note: this name is only accepted and mentioned in the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012), while it is regarded as a synonym of *C. fargesiana* var. *fargesiana* in the WCSP (2016). The present authors did not see the protologue.

9b. ***Carpinus fargesiana*** var. ***ovalifolia*** (H.J.P.Winkl.) Holstein & Weigend comb. nov.

urn:lsid:ipni.org:names:77167104-1

Basionym: *C. turczaninovii* var. *ovalifolia* H.J.P.Winkl., *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 50 (Suppl.): 505 (Winkler 1914). – *C. hwai* Hu & W.C.Cheng, *Bulletin of the Fan Memorial Institute of Biology n.s.* 1: 148 (Hu 1948a). – *C. fargesiana* var. *hwai* (Hu & W.C.Cheng) P.C.Li, *Flora Reipublicae Popularis Sinicae* 21 (2): 82 (Li 1979a) nom. illegit. superfl. – Type: China, Sichuan, No. [North] Wushan, *A. Henry 7020* (lecto-, designated here: P06811189!; isolecto-: BM!, GH00112538!, K000859934!, K000859935!). – Additional type material: China, "N Huan tou shan", *G. Giraldi* s.n. (syn-: not localized); ibid., Sichuan, S Wushan, *A. Henry 7019* (syn-: K000859936!); ibid., distr. Tchen-keou-tin, *P.G.* [*Réverend père*] *Farges 1273* (syn-: P06811190!, P06811191!, P06811192!, P06811194!, P06811503!). Ibid., *P.G.* [*Réverend Père*] *Farges* s.n. (syn-: not localized); ibid., Sichuan [locality unreadable], 7500 ft, May 1903, *E.H. Wilson 4489* (syn-, mentioned in appendix to protologue: BM!, IBSC0368215, K000859932!,

K000859933!). – Note: Hu (1948b) cited Winkler's variety for their new species as the only element (thus, *C. hwai* is a new name, but only legitimate in the rank of a species). When treating this taxon as variety, however, again the name "*ovalifolia*" has priority, which Li apparently overlooked. The lectotype material was mentioned in the appendix of the protologue, and is thus also original material. It bears an annotation of Winkler, and duplicates are distributed in several herbaria, so it seems a good choice for a lectotypification. This taxon is recognized both in the *Flora of China* (Li & Skvortsov 1999) and in the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012: 35).

10. ***Carpinus firmifolia*** (H.J.P.Winkl.) Hu

Bulletin of the Fan Memorial Institute of Biology n.s. 1 (2): 144 (Hu 1948a). – *C. turczaninovii* var. *firmifolia* H.J.P.Winkl., *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 50 (Suppl.): 505 (Winkler 1914). – *C. pubescens* var. *firmifolia* (H.J.P.Winkl.) Hu ex P.C.Li, *Flora Reipublicae Popularis Sinicae* 21 (2): 80 (Li 1979a). – Type: China, Kui-Tscheu [Guizhou], Ma-jo, fr, Sep. 1908, *J. Cavalerie 3135* (holo-: E!; iso-: P04815672!). – Note: accepted as *C. firmifolia* in the *Flora of China* (Li & Skvortsov 1999), but listed as a variety in the *World Checklist of Fagales* (Govaerts & Frodin 1998).

C. pubescens var. *bigiehensis* Hu, *Acta Phytotaxonomica Sinica* 9: 290 (Hu 1964). – Type: China, Kweichow [Guizhou], Bigieh Hsien, Lin-Ku'Gie-Wo, in open woods on rocky cliffs, 1450 m a.s.l., 13 Sep. 1957, *P.H. Yü* [*Yü Pin-Hwa*, 禹平华] *810* (holo-: PE; iso-: IBSC0368211, KUN0590865!, LBG00053917, WUK206962). – Note: it was listed as a synonym of *C. firmifolia* in the *Flora of China* (Li & Skvortsov 1999).

11. ***Carpinus hebestroma*** Yamam.

Supplementa Iconum Plantarum Formosarum 5: 14, fig. 4 (Yamamoto 1932). – Type: R. China, Taiwan, inter Shinjio et Batakan, 26 Apr. 1917, s. coll. [*Y. Yamamoto*?], s.n. (lecto-, designated here: TAI [118773]!). – Additional type material: R. China, Taiwan, inter Batakan et Naitaroko, Apr. 1917, *Y. Yamamoto* s.n. (syn-: not localized).

12. ***Carpinus henryana*** (H.J.P.Winkl.) H.J.P.Winkl.

Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie 50 (Suppl.): 507 (Winkler 1914). – *C. tschonoskii* var. *henryana* H.J.P.Winkl., *Das Pflanzenreich* IV 61 (Heft 19): 36 (Winkler 1904). – *C. hupeana* var. *henryana* (H.J.P.Winkl.) P.C.Li, *Flora Reipublicae Popularis Sinicae* 21 (2): 83 (Li 1979a) nom. illegit. – Type: China, Sichuan, *A. Henry 7063* (holo-: B†; lecto-, designated here: K00859926!; isolecto-: BM!, E00275504!, GH00033755!, P06811429!).

12a. ***Carpinus henryana*** (H.J.P.Winkl.) H.J.P.Winkl. var. ***henryana***

C. henryana var. *chuana* C.C.Yang, *Distribution of the Woody Plants in Sichuan* [四川树木分布]: 661 (Yang 1997). – Type: not localized. – Note: this name is only accepted and mentioned in the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012), while it is regarded as a synonym of *C. henryana* var. *henryana* in the WCSP (2016). The present authors did not see the protologue.

12b. ***Carpinus henryana*** var. ***oblongifolia*** (Hu) Rushforth

Plantsman 8: 249 (Rushforth 1987). – *C. turczaninovii* var. *oblongifolia* Hu, *Sunyatsenia* 1 (2–3): 115 (Hu 1933). – *C. oblongifolia* (Hu) Hu & W.C.Cheng, *Bulletin of the Fan Memorial Institute of Biology n.s.* 1: 146 (Hu 1948a). – Type: China, Kiangsu [Jiangsu], Poa-Hwa Shan, 450 m a.s.l., 23

Jul. 1925, *A.N. Steward 1476* (holo-: PE00021938!). – Note: this taxon is considered as a distinct species in the *Flora of China* (Li & Skvortsov 1999).

C. huana W.C.Cheng, *Contributions from the Biological Laboratory of the Science Society of China, Botanical Series* 9: 68 (Cheng 1933). – Type: China, Zhejiang, [Lin'an City, West Tianmushan], 21 Aug. 1924, *W.C. Cheng 5161* (holo-: PE00021905!). – Additional type material: ibid., 15 Aug. 1931, *K. Ling 3519* (para-: not localized). – Note: *Carpinus huana* is regarded as a synonym of *C. hupeana* in the *Flora of China* (Li & Skvortsov 1999).

C. hupeana Hu, *Sunyatsenia* 1 (2–3): 118 (Hu 1933). – Type: China, Hupeh, Liang Sung kou, 1250 m a.s.l., 9 Sep. 1922, *W.Y. Chun et al. 4173* (holo-: PE00021898!). – Note: *Carpinus hupeana* is accepted as distinct species in *Flora of China* (Li & Skvortsov 1999) with *C. funiushanensis*, *C. huana* and *C. longipes* as synonyms.

C. longipes Hu, *Acta Phytotaxonomica Sinica* 9: 291 (Hu 1964). – Type: China, Kiangsi [Jiangsi], Tasiping Shan, Shih-Cha-pu, 15 Jul. 1949, *Y.K. Hsiung* [*Hsi un Yao-Kuo,* 熊耀国] *5305* (lecto-, designated by Lin *et al.* (2007: 1248): PE00021917!; isolecto-: PE00021915!, PE00021916!). – Note: *Carpinus longipes* is regarded as a synonym of a distinct *C. hupeana* in the *Flora of China* (Li & Skvortsov 1999).

C. funiushanensis P.C.Kuo, *Flora Tsinlingensis* 1 (2): 601 (Instituto Botanico Boreali-occidentali Academiae Sinicae Edita 1974). – Type: China, Henan, 卢氏, 淇河北面山坡 [Lu-shih Hsien], 920 m a.s.l., 14 Sep. 1958, *C.C. Fu* [*J.Q. Fu*, 傅竞秋] *656* (holo-: WUK0407353, WUK0114527; iso-: IBSC0367962, NAS00070304). – Note: *Carpinus funiushanensis* is regarded as a synonym of a distinct *C. hupeana* in the *Flora of China* (Li & Skvortsov 1999). Kuo did not indicate a herbarium for the holotype. As the *Flora Tsinlingensis* is mainly based on material from WUK, the specimens there ought to be regarded as holo- and isotype respectively or as one holotype mounted on two sheets if indicated as one gathering. The specimens from other herbaria are considered as duplicates.

12c. ***Carpinus henryana*** var. ***simplicidentata*** (Hu) Rushforth

Plantsman 8: 249 (Rushforth 1987). – *C. simplicidentata* Hu, *Bulletin of the Fan Memorial Institute of Biology n.s.* 1: 143 (Hu 1948a). – *C. hupeana* var. *simplicidentata* (Hu) P.C.Li, *Flora Reipublicae Popularis Sinicae* 21 (2): 83 (Li 1979a). – Type: China, Hubei, near Chin Tai Po, 2150 m a.s.l., 2 Sep. 1922, *W.Y. Chun 4175* (lecto-, designated by Lin *et al.* (2007: 1249): PE00021955!; isolecto-: PE00021953!, PE00021954!). – Additional type original material: China, Suon Nai Ook, 2150 m a.s.l., 2 Sep. 1922, *W.Y. Chun 4174* (syn-: not localized). – Note: this name is treated in *Flora of China* (Li & Skvortsov 1999) as a synonym of *C. stipulata* (listed as synonym of *C. turczaninovii* here).

13. ***Carpinus insularis*** N.H.Xia, K.S.Pang & Y.H.Tong

Journal of Tropical and Subtropical Botany 22 (2): 121 (Tong *et al.* 2014). – Type: China, Hong Kong, Violet Hill, 22°14′25.30′′ N, 114°11′55.04′′ E, 190 m a.s.l., 21 Aug. 1913, *K.Y. Tam* s.n. (holo-: IBSC0770924; iso-: HK0043873). – Note: according to the original authors *C. insularis* has similarities to *C. hebestroma* and *C. polyneura*.

14. ***Carpinus japonica*** Blume

Museum Botanicum Lugduno-Batavum 1 (20): 308 (Blume 1851) – *Distegocarpus carpinus* Siebold & Zucc., *Abhandlungen der Mathematisch-Physikalischen Klasse der Königlich Bayerischen Akademie der Wissenschaften* 4 (3): 227 (Siebold & Zuccharini 1846). – *Distegocarpus carpinoidis* Siebold & Zucc., *Abhandlungen der Mathematisch-Physikalischen Klasse der Königlich Bayerischen Akademie der Wissenschaften* 4 (3): 240 (Siebold & Zuccharini 1846) orth. var. (of *Distegocarpus carpinus*). – *Carpinus carpinus* (Siebold & Zucc.) Sarg., *Garden and Forest* 6: 364 (Sargent 1893) nom. inval.

(tautonym). – *C. carpinoides* (Siebold & Zucc.) Makino, *The Botanical Magazine* [*Tokyo*] 26: 391 (Makino 1912). – *C. distegocarpus* Koidz., *The Botanical Magazine* [*Tokyo*] 27: 144 (Koidzumi 1913) nom. illegit. superfl. – Type: Japan, s. loc., *H. Bürger* s.n. (lecto-, designated by Akiyama *et al.* (2013: 349): M-0120911!) – Additional original material: Japan, s. loc., *H. Bürger* s.n. (M-0120912!, M-0120914!, M-0120915!, M-0120916!, M-0120917!); ibid., *P.F. von Siebold et al.* s.n. (BR!, BR!, GH00033756!, K000859947!, K000859948!, L0175945!, P06811392?!). – Original material?: s. loc. [via Java], s. coll., s.n. (U1155346!).

C. japonica var. *caudata* H.J.P.Winkl., *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 50 (Suppl.): 488 (Winkler 1914). – Type: Japan, Insel Nippon [Honshu], in den Ontake-Bergen, Aug. 1905, *U.J. Faurie 6641* (lecto-, designated here: BM!).

C. japonica var. *cordifolia* H.J.P.Winkl., *Das Pflanzenreich* IV 61 (Heft 19): 26 (Winkler 1904). – *C. carpinoides* var. *cordifolia* (H.J.P.Winkl.) Makino, *The Botanical Magazine* [*Tokyo*] 26: 391 (Makino 1912) nom. illegit. – Type: Japan, Central Japan [Honshu], im Nikko-Gebirge, *W.F.K. Dönitz* s.n. (holo-: B†).

C. japonica var. *pleioneura* H.J.P.Winkl., *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 50 (Suppl.): 488 (Winkler 1914). – Type: [Japan] Nikko, Prov. Schimotsuke, Sep. 1887, s. coll., s.n. (lecto-, designated here: P06811395!) – Additional type material: Japan, Miyanoschta, *O. Warburg 7756* (syn-: B†?); ibid., Yokohama, May and Oct. 1862, *C.J. Maximowicz* s.n. (syn-: P06811393!).

15. ***Carpinus kawakamii*** Hayata

Icones Plantarum Formosanarum 3: 175, pl. XXXIIIb (Hayata 1913). – Type: R. China, Taiwan, Monte Morrison [Yushan], Oct. 1907, *T. Kawakami* and *U. Mori 1998* (holo-: TI!). – Note: the type cited here is the direct basis for the drawing in plate XXXIIIb, and can therefore be interpreted as the holotype.

15a. ***Carpinus kawakamii*** Hayata var. ***kawakamii***

Note: Accepted in the *Flora of China* (Li & Skvortsov 1999) with a distinct *C. kawakamii* var. *minutiserrata* (Hayata) S.S.Ying, whereas Liao (1996) does not accept an infraspecific taxon in the *Flora of Taiwan*.

C. hogoensis Hayata, *Icones Plantarum Formosanarum* 6: 62 (Hayata 1916). – Type: R. China, Taiwan, Musha [Wu sha], Hōgō [Chunyang], 3500 ft, Apr. 1916, *B. Hayata* s.n. (holo-: not localized; iso-: TAIF!). – Note: *Carpinus hogoensis* is regarded as a synonym of *C. kawakamii* var. *kawakamii* in the *Flora of China* (Li & Skvortsov 1999).

C. sekii Yamam., *Supplementa Iconum Plantarum Formosarum* 5: 12 (Yamamoto 1932). – Type: R. China, Taiwan, in monte Daibusan, 3000 ft, 24 May 1918, *E. Matsuda* s.n. (holo-: TAI [118775]!). – Note: *Carpinus sekii* is regarded as a synonym of *C. kawakamii* var. *kawakamii* in the *Flora of China* (Li & Skvortsov 1999).

C. auriculifera Hayata nom. nud. – Note: *C. auriculifera* is only known from the specimen collected in R. China (Ariko-banti, 1 Feb. 1917, *E. Matsuda* s.n., TAI [035707]!) and is marked as "type". It might have been published, but the protologue was not localized. The specimen, however, clearly belongs to *C. kawakamii*.

15b. ***Carpinus kawakamii*** var. ***minutiserrata*** (Hayata) S.S.Ying

Coloured Illustrated Flora of Taiwan 3: 271 (Ying 1988). – *C. minutiserrata* Hayata, *Icones Plantarum Formosanarum* 3: 177 (Hayata 1913). – Type: R. China, Taiwan, Tandaisha, Apr. 1910, *U. Mori* s.n. (lecto-, designated here: TI!; isolecto-: TAIF007296!, TAIF007300!). – Note: Liao (1996)

synonymizes this name in the *Flora of Taiwan* under *C. kawakamii*, while it is accepted as separate species in the *Flora of China* (Li & Skvortsov 1999).

16. ***Carpinus kweichowensis*** Hu

Sinensia 2: 79, fig. 1 (Hu 1931). – Type: China, Guizhou, Chengfeng Hsien, Pa-na, Si-mi-yao, mixed woods, 24 Oct. 1930, *Y. Tsiang* [蒋英] *4406* (lecto-, designated here: NAS00070306!; isolecto-: A00033757!, BM!, E00275503!, K000859925!, N000053496, NAS00070305!, NY00253862!, PE00021906!, PE00021908!, US00089310!). – Note: the specimen selected here as lectotype is annotated as holotype, but it was not published as such. It is also the specimen depicted in figure 1 in Hu (1931).

C. austroyunnanensis Hu, *Bulletin of the Fan Memorial Institute of Biology n.s.* 1 (3): 213 (Hu 1949). – Type: China, Yunnan Province, Xichou, Hsin cheih, 24 Oct. 1947, *K.M. Feng 12609* [erroneously published as *13609*] (lecto-, designated here: PE00020175!; isolecto-: PE00818041!, WUK0207172). – Note: the type citation of *C. austroyunnanensis* is erroneous, as *K.M. Feng 13609* (PE00792657) was collected the 23 Nov. 1947 and is a *Morinda* species, while *K.M. Feng 12609* was annotated by Hu as *C. austroyunnanensis.*

17. ***Carpinus langaoensis*** Z.Qiang Lu & J.Quan Liu

Phytotaxa 295 (2): 191 (Lu *et al.* 2017). – Type: China, Shaanxi, Langao County, Hengxi Township, 108°48′ E, 32°08′ N, 1170 m a.s.l., 28 Jul. 2016, *Z.Q. Lu 2016LZQ029* (holo-: LZU; iso-: LZU).

18. ***Carpinus laxiflora*** (Siebold & Zucc.) Blume

Museum Botanicum Lugduno-Batavum 1 (20): 309 (Blume 1851). – *Distegocarpus laxiflora* Siebold & Zucc., *Abhandlungen der Mathematisch-Physikalischen Klasse der Königlich Bayerischen Akademie der Wissenschaften* 4 (3): 228 (Siebold & Zuccharini 1846). – Type: Japan, s. loc., *H. Bürger* s.n. (lecto-, designated by Akiyama *et al.* (2013: 349): M-0120909!). – Additional original material: Japan, s. loc., *H. Bürger* s.n. (M-0120907!, M-0120908!); ibid., s. coll. (L0175947! ex herb. P.F. von Siebold s.n., L0175948! ex herb. P.F. von Siebold s.n.); ibid., s. coll. (K000859944!, P06811472!, P06811473!, P06811475!).

C. laxiflora f. *lacera* Hayashi, *Journal of Geobotany* [北陸の植物] 22: 4 (Hayashi 1974). – Type: not localized.

C. laxiflora var. *chartacea* H.Lév., *Bulletin de la Société botanique de France* 51: 424 (Léveillé 1904). – Original citation: without collecting data. – Type: not localized.

C. laxiflora var. *pendula* Miyoshi, *Report of the National Monument Investigation. Plants* [天然紀念物調査報告 植物之部 第 8輯] 8: 45 (Department of the Interior 1928). – *C. laxiflora* f. *pendula* (Miyoshi) Sugim., *New Keys to Japanese Trees* [日本樹木総検索誌]: 117, 458 (Sugimoto 1961). – Original citation: “Ein einziges Exemplar im Grundstück von Jojuin Tempel, Tochigi Präfektur.” [A single exemplar on the area of the Jojuin temple, Tochigi prefecture”; 成就院 in Niregimachi, Kanuma district]. – Type: not localized. – Note: this is tree with hanging branches, better considered as a cultivar. The tree (most likely a clone) still existed in 2013.

C. laxiflora var. *macrophylla* Nakai, *The Botanical Magazine* [*Tokyo*] 45: 112 (Nakai 1931). – *C. laxiflora* f. *macrophylla* (Nakai) W.T.Lee, *Lineamenta Florae Koreae*: 165 (Lee 1996). – Type: South Korea [Gyeonggi-do], in silvis Kôryô prov. Keiki, Gwangreung, 3 Sep. 1930, *T. Nakai 13201* (holo-: TI).

C. laxiflora var. *obtusisquama* Koidz., *Acta Phytotaxonomica et Geobotanica* 9 (2): 73 (Koidzumi 1940). – Type: South Korea, Chiisan [Mt. Jiri-san], Kokiri, 11 Jun. 1935, *G.S. Koidzumi* s.n. (holo-: KYO). – Note: this name is mentioned neither in the *World Checklist* (Govaerts & Frodin 1998) nor in the *Checklist of Korea* (Chang *et al.* 2014a) nor in the WCSP (2016), synonymization unclear.

C. laxiflora var. *longispica* Uyeki, *Suigen Gakuho* 41: 9 (Uyeki & Lee 1924). – Type: South Korea, Chyolla australis, mont Chokē (holo-: SNUA†). – Type: South Korea, Jeollanam-do, Suncheon City, Songkwang-myeon, Seungju-eup, Jukhak-ri, Mt. Jogye-san, near the stream in front of Songkwang Temple, 30 Jun. 1993, *J.I. Jeon* and *D.J. Ha 10005* (neo-, designated by Chang & Chang (2010: 275): SNUA; isoneo-: KH). – Note: Chang *et al.* (2014a) accept *C. laxiflora* var. *longispica* as a distinct taxon with *C. laxiflora* var. *macrothyrsa* as its synonym.

C. laxiflora var. *macrothyrsa* Koidz., *Acta Phytotaxonomica et Geobotanica* 9 (2): 73 (Koidzumi 1940). – Type: South Korea, Mt. Chiisan [Jirisan], Hannyaho, Gawun [Gurae-jun], [Jeollanam-do], 2 Jun. 1935, *S. Okamoto* s.n. (lecto-, designated by Chang & Chang (2010: 276): KYO). – Note: this name is regarded as a synonym of *C. laxiflora* var. *longispica* in Chang *et al.* (2014a).

C. laxiflora var. *gosenensis* Franch. nom. nud. – Note: this name is written on the specimen only: Japan, Niigata, Montagnes de Gosen, 28 Jul. 1874, *U.J. Faurie* s.n. (P06811469!).

C. laxiflora var. *onoei* nom. nud. – Note: this name is written on the specimens only: Japan, [Chūbu], Ono [Ōno], *L. Savatier 2935* (P06811464!); ibid., s. coll., s.n. (P06811462!).

19. ***Carpinus lipoensis*** Y.K.Li

Guizhou Science 1983 (2): 20 (Li & Mang 1983). – Type: China, Guizhou, Lipo, in sylvis montium calcareum, 850 m a.s.l., *Y.K. Li* [李永康] *9940* (holo-: HGAS? ex "Herb. Inst. Biol. Guizhou"). – Note: this name is neither listed in the *World Checklist* (Govaerts & Frodin 1998) nor in the *Flora of China* (Li & Skvortsov 1999).

20. ***Carpinus londoniana*** H.J.P.Winkl.

Das Pflanzenreich IV 61 (Heft 19): 32 (Winkler 1904). – Type: China, Yunnan, 4000 ft, *A. Henry 11640* (lecto-, designated here: K000859945!; isolecto-: A00033759!, B†, E00275498!, K000859946!, MO-2140881!, MO-2140882!, NY00253864!).

20a. ***Carpinus londoniana*** H.J.P.Winkl. var. ***londoniana***

C. poilanei A.Camus, *Bulletin de la Société botanique de France* 76: 968 (Camus 1930). – Type: Vietnam, Annam, Lang-bian, entre Dran et Dung-Lo, *E. Poilane 3983* (lecto-, designated here: P06811169!). – Additional type material: Vietnam, Dalat en face de Manline, *F. Evrard 1168* (syn-: P06811171!).

C. poilanei var. *chevalieri* A.Camus, *Bulletin de la Société botanique de France* 76: 969 (Camus 1930). – Type: Vietnam, Annam, plateau du Langbian, entre Bellevue et Dran, 30 Apr. 1919, *A. Chevalier 40445* (lecto-, designated here: P06747035!; isolecto-: P06747037!, P06811163!). – Additional type material: Vietnam, Belle [Bellevue], 17 Jun. 1921, *B. Hayata 707* (syn-: P06811154!); ibid., Dalat, chemin de la montagne de l'éléphant ruisseau de Prenh, 29 Nov. 1924, *F. Evrard 1918* (syn-: P06811160!).

20b. ***Carpinus londoniana*** var. ***lanceolata*** (Hand.-Mazz.) P.C.Li

Flora Reipublicae Popularis Sinicae 21 (2): 68 (Li 1979a). – *C. lanceolata* Hand.-Mazz., *Oesterreichische Botanische Zeitschrift* 80: 338 (Handel-Mazzetti 1931). – Type: China, Hainan, Ngitse-leng, *G. Fenzel 159* (holo-: not localized). – Additional type material: China, Hainan, secus rivos in media insula, 300–500 m a.s.l., Oct.–Nov. 1929, *G. Fenzel 106* (para-: not localized); ibid., Ngitse-leng, in glarea, *G. Fenzel 164* (para-: not localized).

20c. ***Carpinus londoniana*** var. ***latifolia*** P.C.Li

Acta Phytotaxonomica Sinica 17 (1): 87 (Li 1979b) [corrected from "*latifolius*"]. – Type: China, Chekiang [Zhejiang], Ning-po [Ningbo (宁波)], s. coll. *1018* (holo-: PE).

20d. ***Carpinus londoniana*** var. ***xiphobracteata*** P.C.Li

Acta Phytotaxonomica Sinica 17 (1): 87 (Li 1979b). – Type: China, Chekiang [Zhejiang], Yin Hsien [Yin Xian (鄞县)], *G.R. Chen* [*Chen Gun-rung*] *2289* (holo-: PE).

21. ***Carpinus luochengensis*** J.Y.Liang

Guihaia 6 (4): 275 (Liang 1986). – Type: China, Guangxi, Luocheng, 28 Jul. 1983, *J.Y. Liang K1644* (holo-: IBK00190892!). – Additional type material: ibid., 5 Aug. 1984, *F.N. Wei* [*Wei Fa-Nan*, 韦发南] *1743* (para-: IBK00190885!, IBK00190886!). – Note: not mentioned in the *Flora of China* (Li & Skvortsov 1999).

22. ***Carpinus mengshanensis*** S.B.Liang & F.Z.Zhao

Bulletin of Botanical Research, Harbin 11 (2): 33 (Liang & Zhao 1991). – Type: China, Shandong, Pingyi Xian, Meng Shan, 750 m a.s.l., Oct. 1984, *F.Z. Zhao 84001* (holo-: SDFS). – Note: not mentioned in the *Flora of China* (Li & Skvortsov 1999).

23. ***Carpinus microphylla*** Z.C.Chen ex Y.S.Wang & J.P.Huang

Guihaia 5 (1): 15 (Wang & Huang 1985). – Type: China, Guangxi, Tianyang Xian, 750 m a.s.l., 16 May 1964, *Z.C. Chen 54089* (holo-: IBK00079486!). – Note: the holotype location is given by the authors as "HIBG" but according to the *Index Herbariorum* (Thiers 2016), HIBG is the herbarium of Hiroshima Botanical Garden. According to the Mandarin text, the holotype is deposited in the "Guangxi Institute of Botany", which is IBK.

24. ***Carpinus mollicoma*** Hu

Bulletin of the Fan Memorial Institute of Biology n.s. 1 (3): 216 (Hu 1949). – *C. polyneura* var. *mollicoma* (Hu) C.C.Yang, *Distribution of the Woody Plants in Sichuan* [四川树木分布]: 42 (Yang 1997). – Type: China, Yunnan, Xichou, Faa-doou, 25 Sep. 1947, *K.M. Feng 12053* (lecto-, designated here: PE00021946!; isolecto-: IBSC0368097, PE00818159!). – Note: *Carpinus mollicoma* is accepted in the *Flora of China* (Li & Skvortsov 1999) and the *World Checklist* (Govaerts & Frodin 1998). Yang in *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012: 35) notes that his combination *C. polyneura* var. *mollicoma* (Hu) C.C.Yang is a nom. nud. [comb. inval.?] in the 1997 publication, but he treats it as a distinct variety in *C. polyneura* in 2012. If there was no reference to the basionym in the cited reference, then the new combination was published in 2012.

25. ***Carpinus monbeigiana*** Hand.-Mazz.

Anzeiger der oesterreichischen Akademie der Wissenschaften mathematisch-naturwissenschaftliche Klasse 61: 162 (Handel-Mazzetti 1925). – Original citation: "In silvis dumetisque calide temperatis inter Dawan et Gwanyilang, legi 3. VII. 1914 (Nr. 3431) et supra Schidsilu, legi 30. VI. 1914 (Nr. 3331) prope urbem Yungbe. Certe in subtropicis ad fluvium Mekong leg. Monbeig 1908 ibique observavi infra vicum Gangpi eandemque verosimiliter ad fl. Salwin circa Tschammutong pluries." – Type: China, Yunnan, prope urbem Yungbei, in regionis calide temperatae silvis inter vicos Dawan et Swanyilang, 2400–2600 m a.s.l., 3 Jul. 1914, *H.R.E. von Handel-Mazzetti 3431* (lecto-, designated

here: WU030928!; isolecto-: E00275494!, K!). – Additional type material: China, Yunnan, prope urbem Yungbei, in regionis calide temperatae dumetis supra vic. Schidsilu, 2400–2700 m a.s.l., 30 Jun. 1914, *H.R.E. von Handel-Mazzetti 3324* (syn-: WU030929!); ibid., am Mekong, 2400–2600 m a.s.l., *J.T. Monbeig 1908* (syn-: not localized).

C. densispica Hu, *Acta Phytotaxonomica Sinica* 9: 286 (Hu 1964). – Type: China, [Yunnan], Tehchin Hsien, Tzichung, Sila, 2500–2800 m a.s.l., in mixed forest, 19 [in protologue "18"] Jul. 1940, *K.M. Feng 5618* (lecto-, designated here: PE00021886!; isolecto-: PE01062146!). – Additional type material: China, [Yunnan], Weisi Hsien, Kangpu, at 2300 m a.s.l., in mixed woods, Jul. 1938, *C.W. Wang* [王启无] *64343* (para-: PE01062148!).

C. likiangensis Hu, *Acta Phytotaxonomica Sinica* 9: 287 (Hu 1964). – Type: China, Yunnan, Likiang Hsien, Snow range, 2700 m a.s.l., in mixed forest, 18 Aug. 1942, *K.M. Feng 9055* (lecto-, designated by Lin *et al.* (2007: 1248): PE00021913!; isolecto-: PE00021914!). – Additional type material: ibid., 2400 m a.s.l., 19 Sep. 1955, *K.M. Feng 21595* (para-: PE00021912!, PE00818189!).

C. monbeigiana var. *weisiensis* Hu, *Acta Phytotaxonomica Sinica* 9: 285 (Hu 1964). – Type: China, Yunnan, Weisi Hsien [Weixi Lisu Autonomous County], Yehchi, 2040 m a.s.l., 24 Aug. 1956, *P.Y. Mao* [*Mao Ping-yi/Mao Pin-yih*, 毛品一] *197* (lecto-, designated here: PE00021933!; isolecto-: PE00021934!).

26. ***Carpinus omeiensis*** Hu & Fang

Acta Phytotaxonomica Sinica 9: 296 (Hu 1964). – Type: China, Sichuan, Mount Omei [Éméi Shān], Dashiaochenfeng, 1900 m a.s.l., 7 Oct. 1957, *K.H. Yang* [*Yang Kuang-Hway*, 杨光辉] *57490* (lecto-, designated here: PE00021939!; isolecto-: IBSC0368104, KUN0590785!, NAS00070308, PE00818214!). – Additional type material: China, Guizhou, Teking Hsien, Yaimenko, 1200 m a.s.l., in dense forest on slope, 15 Aug. 1959, *North Kweichow Exped.* [黔北队] *1631* (para-: KUN0590783!, NAS00070309!, PE00818217!, PE00818218!).

27. ***Carpinus orientalis*** Mill.

The Gardeners Dictionary ed. 8, no. 3 (Miller 1768). – *C. nigra* Moench, *Verzeichniss ausländischer Bäume und Stauden*: 19 (Moench 1785) nom. illegit. superfl. – Type: Oriens, *J.P. de Tournefort* s.n. (lecto-, designated here: BM!). – Additional original material: Oriens, *J.P. de Tournefort* s.n. (P [*Tournefort 5561*], LINN no. HS1481.2!, LINN no. HS1481.3!). – Note: the Tournefort specimen in BM was designated to be lectotype because 1) Miller cited Tournefort's Corollarium T. 40 in the protologue, just as given on the label and 2) Miller's material is deposited in BM (Stafleu & Cowan 1976–1988). The other specimen in BM, dating from that time (BM001041899), is a cultivar from Leiden ("Hort. B$^{ni.}$ [botanici] Boerhaave"). Miller most likely had material from Boerhaave at hand, but he did not mention cultivated material from Leiden in the protologue. Hence it be or may not be that this specimen could be considered as original material. There are two *C. orientalis* specimens in the Smith Herbarium (LINN-HS 1481.2 and LINN-HS 1481.3). One (LINN-HS 1481.3) refers only to Tournefort's *Institutiones Rei Herbariae* (Tournefort 1700) and the other one to both Tournefort's publications (Tournefort 1700, 1703) but not to the actual page number in contrast to the specimen in BM. Additionally, Miller did not refer to the *Institutiones Rei Herbariae* nor do the LINN specimens match the description since they have (sub-)acute leaf apices, while Miller explicitely refers to obtuse apices. Hence, we do not believe that Miller saw the material in the Smith Herbarium for his description. The lectotypification with the Tournefort specimen in Paris by Olshanskyi (2014: 68) is not effective because the author forgot the phrase "designated here" or an equivalent (Art. 7.10, McNeill *et al.* 2012). We deviate from his suggestion because Miller's herbarium is in fact now located in BM (Stafleu & Cowan 1976–1988), hence lectotypes of his names should preferably be placed there.

27a. ***Carpinus orientalis*** Mill. var. ***orientalis***

C. duinensis Scop., *Flora Carniolica ed. 2*, 2: 243 (Scopoli 1772). – Original citation: "circa Duinum" [Duino]. – Type: not localized.

C. minor Pall., *Bemerkungen auf einer Reise in die Südlichen Statthalterschaften des Russischen Reichs* 2: 95 (Pallas 1801). – Original citation: "Sobald man den Belbek [a river], etwa zwölf Werste von Bachtschisarai [Bakhchysarai] durchfahren hat." [This is a locality on Crimea, and the plant must have been collected soon after Easter 1793]. – Type: not localized.

C. betulus var. *edentula* Heuff., *Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien* 8: 196 (Heuffel 1858). – *C. edentula* Kit., *Descriptiones et Icones Plantarum Rariorum Hungariae* 2: XXXII (Waldstein & Kitaibel 1803–1805) nom. nud. – Original citation: "Smyrmium et Banatum inhabitant." – Type: In Comitatu Syrmiensi et in sylvis Banatus atque Serviae, *P. Kitaibel A57* (lecto-, designated here: BP-XL/144!; isolecto-: B-W 17700–030!). – Additional original material: s. loc., *A. Wolny* s.n. (BP-XL/86! ex herb. P. Kitaibel). – Note: *Carpinus edentula* is a nom. nud. appearing first in Kitaibel's diary in 1804 (cf. Mólnar 2015). Spach (1842: 221) separates this name in a key, and refers to a "*Carpinus edentula* Roch. Bann.". Rochel (1828: 26) just listed this name as having been communicated by Kitaibel. Steudel (1840: 300) published this name again, but only mentions the perennial life form and the origin, so his publication cannot be considered as valid, and Spach (1842: 221) published it as synonym to an invalid *C. betulus* var. *β*. In 1858, Heuffel recognized Kitaibel's name as a variety of *C. betulus* and amended it with a description thus validating the name.

C. orientalis f. *umbraculifera* (Beissn.) Schelle, *Handbuch der Laubholzbenennung*: 49 (Beissner *et al.* 1903). – *C. orientalis* [unranked] *umbraculifera* Beissn., *Mitteilungen der Deutschen dendrologischen Gesellschaft* 8: 133 (Beissner 1899a). – *C. betulus* [unranked] *umbraculifera* hort. ex Beissn., *Mitteilungen der Deutschen dendrologischen Gesellschaft* 8: 133 (Beissner 1899a) nom. inval. (not accepted by the author). – Original citation: "Schloss Eisenberg ist herrlich oben am dicht bewaldeten Erzgebirge gelegen, im tiefer liegenden Park". – Type: not localized. – Note: Beissner mentioned a cultivar with a spherical crown that has been called *C. betulus umbraculifera*, but he supposed it to be a *C. orientalis*. A definite rank was given in 1903.

C. orientalis f. *calcarea* Radde-Fom., *Trudy fizychno-matematychnogo viddilu. Kiev* [*Mémoires de la Classe des Sciences Physiques et Mathématiques de l'Académie des Sciences de l'Ukraine*] 15 (1): 95 (Radde-Fomina 1929). – Original citation: "Prov. Czernomorskaja, distr. Novorossijsk, ad capitem Dob, prope pag. Kabardinka. 30 VI. 1912, [D.I.] Sosnowsky!" – Type: not localized.

C. orientalis var. *coronata* Radde-Fom., *Trudy fizychno-matematychnogo viddilu. Kiev* [*Mémoires de la Classe des Sciences Physiques et Mathématiques de l'Académie des Sciences de l'Ukraine*] 15 (1): 107 (Radde-Fomina 1929). – *C. coronata* Schischk. nom. nud. – Original citation: "Anatolien, Trapezund, unterer Teil des Deïrmen-dere-Tales; Gebüsch westlichen Abhängen, 12 Juni 1917." – Type: not localized (LE?).

C. orientalis var. *gibbosa* Radde-Fom., *Trudy fizychno-matematychnogo viddilu. Kiev* [*Mémoires de la Classe des Sciences Physiques et Mathématiques de l'Académie des Sciences de l'Ukraine*] 15 (1): 107 (Radde-Fomina 1929). – *C. ovata* Schischk. ex Radde-Fom., *Trudy fizychno-matematychnogo viddilu. Kiev* [*Mémoires de la Classe des Sciences Physiques et Mathématiques de l'Académie des Sciences de l'Ukraine*] 15 (1): 107 (Radde-Fomina 1929) nom. inval. pro syn. – Original citation: "Anatolien, Sandshak Trapezund, Schlucht Gadshevara, zwischen Platana und Fol; Abhänge mit Gebüsch. 27. Juni 1917." – Type: not localized (LE?). – Note: *Carpinus ovata* was a name suggested by Schischkin on a herbarium specimen that he had sent to Radde-Fomina for revision. She suggested that this plant should be called "*C. orientalis* var. *gibbosa*" instead of being described as a new species.

C. orientalis f. *grandifolia* Radde-Fom., *Trudy fizychno-matematychnogo viddilu. Kiev* [*Mémoires de la Classe des Sciences Physiques et Mathématiques de l'Académie des Sciences de l'Ukraine*]

15 (1): 94 (Radde-Fomina 1929). – Original citation: "Tauria ad viam e Simpheropol in Aluschtam" [Alushta], VIII. 1925, leg. N. Dubowik!" – Type: not localized.

C. paucicostata Schischk. ex Radde-Fom., *Trudy fizychno-matematychnogo viddilu. Kiev* [*Mémoires de la Classe des Sciences Physiques et Mathématiques de l'Académie des Sciences de l'Ukraine*] 15 (1): 107 (Radde-Fomina 1929) nom. inval. pro syn. – Note: Radde-Fomina regarded Schischkin's plant as a mere *C. orientalis.* However, she indicated that he intended to describe the name later on. This name is therefore provisional and invalid here. The present authors were unable to locate a later, validating publication.

C. orientalis f. *banatica* Kárp., *Botanikai Közlemények* 34: 194 (Kárpáti 1937). – Original citation: "Im Banat bei Herkulesbad" [Băile Herculane, Romania]. – Type: not localized. – Note: this is supposed to be a narrow-leaved form.

27b. ***Carpinus orientalis*** subsp. ***macrocarpa*** (Willk.) Browicz

Flora Iranica 97: 2 (Browicz 1972). – *C. orientalis* var. *macrocarpa* Willk., *Forstliche Flora von Deutschland und Oesterreich ed. 2*: 368 (Willkomm 1887). – *C. macrocarpa* (Willk.) H.J.P.Winkl., *Das Pflanzenreich* IV 61 (Heft 19): 38 (Winkler 1904). – *C. orientalis* f. *macrocarpa* (Willk.) Radde-Fom., *Trudy fizychno-matematychnogo viddilu. Kiev* [*Mémoires de la Classe des Sciences Physiques et Mathématiques de l'Académie des Sciences de l'Ukraine*] 15 (1): 90 (Radde-Fomina 1929) nom. nud. pro syn. – Original citation: "In Turkomanien hat [G.S.] Karelin". – Type: not localized. – Note: The published combination *C. orientalis* f. *macrocarpa* as a synonym was a misunderstanding by Radde-Fomina. She believed that Medwedew (1909: 32) regarded the taxon as a *forma*. However, he used the term "form" informally only, because "form" appears in only the text (Medwedew 1909: 32) while "var. *macrocarpa*" is written explicitly in the appendix (Medwedew 1909: 41). Medwedew's name is unranked, but would have been a later homonym anyway.

28. ***Carpinus paohsingensis*** W.Y.Hsia

Contributions from the Institute of Botany, National Academy of Peiping 2: 179 (Hsia 1934). – Type: China, Sichuan, Paohsing-hsien (Mupin) [Baoxing], 1960 m a.s.l., 8 Jul. 1933, *T.H. Tu 4356* (lecto-, designated here: PE00021940!; isolecto-: IBK00079502!, IBSC0368268, PE00021941!). – Note: *Carpinus paohsingensis* is accepted in the *World Checklist* (Govaerts & Frodin 1998), but accepted neither in the *Flora of China* (Li & Skvortsov 1999) nor by Chang *et al.* (2014a) but listed as synonymous with *C. tschonoskii*.

C. falcatibracteata Hu, *Acta Phytotaxonomica Sinica* 9: 297 (Hu 1964). – *C. tschonoskii* var. *falcatibracteata* (Hu) P.C.Li, *Flora Reipublicae Popularis Sinicae* 21 (2): 85 (Li 1979a). – Type: China, Sichuan, Hunghwa to Wali, 1900 m a.s.l., 14 Jul. 1959, *Szechuan Econ. Bot. Liangshan Exp.* [四川经济植物（凉山）调查队] *1219* (lecto-, designated here: PE00021887!; isolecto-: CDBI0172170!, PE00802589!). – Additional type material: China, Sichuan, Le-Po-Hsien, on open mountain slope, 1950 m a.s.l., 8 Aug. 1934, *T.T. Yu* [俞德浚] *3639* (para-: IBSC0368265, IBSC0368266, IBSC0368269, PE00802576!, WUK0330666); ibid., Liang Ho-Ko, in forest, 1700 m a.s.l., 28 Sep. 1930, *F.T. Wang 22597* (para-: PE00802565!); ibid., Kiangsi [Jiangxi], Shui Swe Hsien, Mofu Shan, along gully, 10 Sep. 1947, *Y.K. Hsiung* [*Hsiung Yao-Kuo*/熊耀国] *5830* (para-: LBG00001770!, PE00802561!, PE00802562!, PE00802563!). – Note: this name is neither accepted in the *World Checklist* (Govaerts & Frodin 1998) nor in the *Flora of China* (Li & Skvortsov 1999) nor by Chang *et al.* (2014a). It is regarded in the first treatment as a synonym of *C. paohsingensis*, which itself is treated as synonymous with *C. tschonoskii* in the latter two treatments. In the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012), it is accepted *pro parte minore* as distinct variety of *C. tschonoskii*, while the rest ought to be synonymous with *C. tschonoskii* and with *C. paohsingensis* as full synonym of *C. tschonoskii*.

C. obovatifolia Hu, *Acta Phytotaxonomica Sinica* 9: 289 (Hu 1964). – Type: China, Yunnan, Tsenyih Hsien, Shiao-Ma-La in forest, 1954, *Y.H. Li* [*Li Yen-hei*, 李延辉] *150* (lecto-, designated by Lin *et al.* (2007: 1249): PE00021937!; isolecto-: PE00021936!). – Note: this name is listed as synonymous with *C. tschonoskii* in the *Flora of China* (Li & Skvortsov 1999), in the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012), and by Chang *et al.* (2014a) for the *Flora of Korea*, while it is synonymous with *C. paohsingensis* in the *World Checklist* (Govaerts & Frodin 1998).

29. ***Carpinus polyneura*** Franch.

Journal de Botanique [*Morot*] 13: 202 (Franchet 1899). – *C. turczaninovii* var. *polyneura* (Franch.) H.J.P.Winkl., *Das Pflanzenreich* IV 61 (Heft 19): 38 (Winkler 1904). – Type: China, Sutchuen [Sichuan], in ditione Tchen keou tin [Chengkou County], *P.G.* (*Reverend Père*) *Farges* s.n. (lecto-, designated here: P06811144!; isolecto-: P06811145!?, P06811146!). – Note: *Carpinus polyneura* is accepted as a species, with the two varieties (with *C. polyneura* var. *sungpanensis*) that are listed here, in the *World Checklist* (Govaerts & Frodin 1998) and in the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012), but they are accepted as two distinct species in the *Flora of China* (Li & Skvortsov 1999).

29a. ***Carpinus polyneura*** Franch. var. ***polyneura***

C. handelii Rehder, *Journal of the Arnold Arboretum* 1: 59 (Rehder 1919). – Type: China, Hunan, inter urbes Linling (Yungchoufu) e Sinning in silvis collium supra vicum Tjentiesse, 400 m a.s.l., 14 Aug. 1917, *H.R.E. von Handel-Mazzetti 421* (holo-: A00033754!; iso-: WU 30926!). – Type: China, Hunan, in silva infra Tungdjiapai prope minas Hsikwangchan, dist. Hsinhwa, 550 m a.s.l., 20 May 1918, *H.R.E. von Handel-Mazzetti 11884* ["*534*"] (para-: E!, P06811414!, WU 30927!). – Note: this name is listed as a synonym of *C. polyneura* in the *World Checklist* (Govaerts & Frodin 1998), in the *Flora of China* (Li & Skvortsov 1999), and in the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012). Rehder cites the type as "*421*", which is a crossed-out number written with a pencil only on the specimen in A. It is therefore the specimen that Rehder explicitly cited and type, as the WU duplicate does not contain that number.

C. polyneura var. *glandulosopunctata* C.J.Qi, *Acta Phytotaxonomica Sinica* 22 (6): 494 (Qi 1984). – *C. glandulosopunctata* (C.J.Qi) C.J.Qi, *Bulletin of Botanical Research, Harbin* 20 (1): 3 (Lin & Qi 2000) ["glanduloso-punctata"]. – Type: China, Hunan, Ningxiang, on hillside, 200 m a.s.l., 10 Oct. 1982, *Y.T. Xiao* [*Xiao Yu-tan*] *40004* (holo-: CSFI; iso-: PE). – Note: this name is listed as a synonym of *C. polyneura* in the *World Checklist* (Govaerts & Frodin 1998), but it is not mentioned otherwise.

C. polyneura var. *wilsoniana* H.J.P.Winkl., *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 50 (Suppl.): 506 (Winkler 1914). – Type: China, [Sichuan,] am Berge Omi [Éméi Shān], May 1904, *E.H. Wilson 5791* (lecto-, designated here: K000859929!; isolecto-: A00033763!, BM!). – Additional type material: China, Hupeh, *E.H. Wilson 1170* p.p. (syn-: W). – Note: This name is mentioned neither in the *World Checklist* (Govaerts & Frodin 1998) nor in the *Flora of China* (Li & Skvortsov 1999) nor in the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012).

29b. ***Carpinus polyneura*** var. ***sungpanensis*** (W.Y.Hsia) P.C.Li

Flora Reipublicae Popularis Sinicae 21 (2): 86 (Li 1979a). – *C. sungpanensis* W.Y.Hsia, *Contributions from the Institute of Botany, National Academy of Peiping* 2: 180 (Hsia 1934). – *C. tschonoskii* var. *sungpanensis* (W.Y.Hsia) C.C.Yang, *Distribution of the Woody Plants in Sichuan* [四川树木分布]: 42 (Yang 1997). – Type: China, Sichuan, Sungpan-Hsien, 2050 m a.s.l., 16 Sep. 1932, *T.T. Yü 2580* (lecto-, designated here: PE01062157!; isolecto-: IBSC0368164, IBSC0368182, PE01062158!). – Note: the taxon is accepted as a distinct species in *Flora of China* (Li & Skvortsov 1999), but treated

as a variety of *C. polyneura* in the *World Checklist* (Govaerts & Frodin 1998) and in the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012).

29c. ***Carpinus polyneura*** var. ***tsunyihensis*** (Hu) P.C.Li

Flora Reipublicae Popularis Sinicae 21 (2): 88 (Li 1979a). – *C. tsunyihensis* Hu, *Acta Phytotaxonomica Sinica* 9: 296 (Hu 1964). – Type: China, Kweichow [Guizhou], Tsunyih Hsien, Nanchien Shan, on hilly slope, 900–1050 m a.s.l., 17 Aug. 1956, *Szechuan-Kweichow Exp. 973* (holo-: PE00818388!). – Note: this taxon is accepted as a distinct species in the *Flora of China* (Li & Skvortsov 1999), but it is considered as a variety of *C. polyneura* in the *World Checklist* (Govaerts & Frodin 1998) and in the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012).

30. ***Carpinus pubescens*** Burkill

Journal of the Linnean Society, Botany 26 (178): 502 (Forbes & Hemsley 1899) ["1890"]. – Type: China, Yunnan, Mi-lê district, *A. Henry 9929* (holo-: K000859939!; iso-: A00033764!, E00275493!, NY00253866!, PE00934232!).

C. seemeniana Diels, *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 29: 279 (Diels 1901). – *C. pubescens* var. *seemeniana* (Diels) Hu, *Acta Phytotaxonomica Sinica* 9: 290 (Hu 1964). – Type: China, S Nan ch'uan, Shan tzu p'ing, Wald, Aug., *C. Bock* and *A. von Rosthorn* ["*BvR*"] *294* (lecto-, designated here: GZU-Rosthorn 000261231!; isolecto-: A00033767!, B†, K000859940!).

C. pinfaensis H.Lév. & Vaniot, *Bulletin de la Société botanique de France* 52: 142 (Léveillé 1905). – Type: China, Kouy-tchéou, Pin-fa, 28 Mar. 1903, *J. Cavalerie 1011* (holo-: E00275492!; iso-: A00077469!).

C. austrosinensis Hu, *Sinensia* 2: 87, fig. 4 (Hu 1931). – Type: China, Kweichow [Guizhou], Anlung, in lightly shaded mixed woods, 620 m a.s.l., 22 Oct. 1930, *Y. Tsiang* [蒋英] *7470* (holo-: not localized; iso-: A00033748!, BM000580520!, E00275505!, IBSC0368184, K000859927!, N000053493, NY00253859!, P06747032!, PE00020176!, PE00020177!, US00089311!). – Note: the type shown in Hu (1931: fig. 4) is not among the specimens seen.

C. kweitingensis Hu, *Sinensia* 2: 82, fig. 2 (Hu 1931). – *C. pubescens* var. *kweitingensis* (Hu) Hu, *Acta Phytotaxonomica Sinica* 9: 290 (Hu 1964). – Type: China, Guizhou, Guiding/Kweiting: Pingfa, light shaded woods, 400–550 m a.s.l., 29 Jun. 1930, *Y. Tsiang* [蒋英] *5440* (holo-: not localized; iso-: A00077466!, A00077467!, E00275502!, IBSC0001132, M-0265493!, NAS00070311!, P06811206!, PE00021904!). – Note: the type shown in Hu (1931: fig. 2) is not among the specimens seen.

C. tsiangiana Hu, *Sinensia* 2: 90, fig. 5 (Hu 1931). – Type: China, Guizhou, Kwangcheng, open hillsides, 23 Jul. 1930, *Y. Tsiang* [蒋英] *8610* (lecto-, designated here: NAS00070318!; isolecto-: A00033770!, BM000580521!, E00275491!, K000859920!, NAS00070312!, NAS00070313!, NAS00070314!, NY00253867!, PE00021964!, US00089309!). – Note: the specimen chosen as lectotype here is the one depicted in Hu (1931: fig. 5).

C. tungtzeensis Hu, *Sinensia* 2: 85, fig. 3 (Hu 1931). – Type: China, Guizhou, Tungtze. 450 m a.s.l. (1476.4 ft.), 26 May 1930, *Y. Tsiang* [蒋英] *5111* (syn-: NAS00070319, NAS00070320, NAS00070321; isosyn-: BM000580523!, K000859921!, N000053499, NY00253868!, PE00021966!, PE00021967!, US00089308!).

C. kweiyangensis Hu, *Bulletin of the Fan Memorial Institute of Biology n.s.* 1 (2): 187 (Hu 1948b). – Type: China, Kweichow [Guizhou], Kweiyang [贵阳市, Guiyang], Chen-lin Shan, 10 Oct. 1937, *P.C. Tsoong* [钟补勤] *1118* (holo-: PE00021948!).

C. lancilimba Hu, *Bulletin of the Fan Memorial Institute of Biology n.s.* 1 (2): 185 (Hu 1948b). – Type: China, Kweichow [Guizhou], Tse-ching Hsien [Zhijin Co., 织金县], [Dongshan, 县东山], 28 Oct. 1938, *P.C. Tsoong* [钟补勤] *1879* (lecto-, designated here: PE00021909!; isolecto-: PE00021910!).

C. pilosinucula Hu, *Bulletin of the Fan Memorial Institute of Biology n.s.* 1 (2): 142 (Hu 1948a). – Type: China, Guizhou, Anlong Co., 15 Jul. 1940, *P.C. Tsoong* [钟补勤] *1536* (holo-: PE00021943!).

C. pingpienensis Hu, *Bulletin of the Fan Memorial Institute of Biology n.s.* 1 (2): 188 (Hu 1948b). – Type: China, Yunnan, Ping-pien Hsien, 1500 m a.s.l., 18 Jul. 1934, *H.T. Tsai* [*Tsai Hsi-Tao*, 蔡希陶] *60994* (holo-: PE00021944!; iso-: IBSC0368199, LBG00053976!, WUK0046644).

C. tsoongiana Hu, *Bulletin of the Fan Memorial Institute of Biology n.s.* 1 (2): 186 (Hu 1948b). – Type: China, Kweichow [Guizhou], Yungchun Hsien, on rocky slope along river [贵州省, 从江县, Guizhou Province from River County], 29 Jul. 1937, *P.C. Tsoong* [钟补勤] *1084* (holo-: PE00021965!).

C. wangii Hu & W.C.Cheng, *Bulletin of the Fan Memorial Institute of Biology n.s.* 1 (2): 147 (Hu 1948a). – Type: China, Yunnan, Foo-ning, Lung-mai, on rocky hill, 1000 m a.s.l., *C.W. Wang* [王启无] *89104* (holo-: not localized; iso-: KUN0590973!).

C. marlipoensis Hu, *Bulletin of the Fan Memorial Institute of Biology n.s.* 1 (3): 215 (Hu 1949). – Type: China, Yunnan, Malipo County, Pan-chia-chu, 31 Oct. 1947, *K.M. Feng 12619* (lecto-, designated here: PE00021921!; isolecto-: PE00021922!, WUK0207179).

C. marlipoensis var. *angustifolia* Hu, *Acta Phytotaxonomica Sinica* 9: 288 (Hu 1964). – Type: China, Yunnan, Faadou, 1400 m a.s.l., in mixed forests on rocky hills, 24 May 1943, *P.C. Tsoong* and *K.Z. Kuang* [钟补勤、匡可任] *426* (lecto-, designated here: PE00021925!; isolecto-: IBSC0368204, PE00021923!, PE00021924!).

C. parva Hu, *Acta Phytotaxonomica Sinica* 9: 292 (Hu 1964). – Type: China, SE Yunnan: Sichour Hsien, in shrubbery on cretaceous cliff, 1600 m a.s.l., 17 Oct. 1958, *H.T. Tsai* [*Tsai Hsi-Tao*, 蔡希陶] *58–8559* (holo-: PE00021942!).

C. pingpienensis var. *lichuanensis* W.C.Cheng, 科学 [*Science*] 32 (8): 246 (Cheng 1950) nom. nud.? – *C. pingpienensis* var. *lichuanensis* W.C.Cheng, 湖北植物志 [*Flora Hupehensis*] 1: 95 (Hubei Institute of Botany 1976) nom. nud. – *C. pingpienensis* var. *hupehensis* W.C.Cheng nom. nud. – Note: The name "*C. pingpienensis* var. *hupehensis*" only appears on the specimens PE00021911!, A00033762 and K000859922! (China, [Hubei,] Li-Chuan, Hsio-Ho, Long-Tawn-Pu, in forest, 4100 ft, 13 Sep. 1948, *W.C. Cheng* and *C.T. Hwa 950*) and appears to be provisional. Cheng annotated the PE specimen in 1960 as "*Carpinus lichuanensis* Hu" and as "*Carpinus pingpienensis* var. *lichuanensis*" in 1967. Tang (1987) cited the name *C. pingpienensis* var. *lichuanensis* as a "n.n." (nom. nud.) as does Chen (2015). The present authors did not find the protologue for validation. Synonymization follows Tang (2007) as the name is not mentioned in the *Flora of China* (Li & Skvortsov 1999).

C. whilungpaensis W.C.Cheng, 科学 [*Science*] 32 (8): 246 (Cheng 1950) nom. nud.? – Note: Tang (2007) cited this name as a "n.n." [nomen nudum?] found on a specimen of *W.C. Cheng* and *C.T. Hwa 866* (duplicate without that note: K!). The present authors did not find the protologue, and the name is not cited in the *Flora of China* (Li & Skvortsov 1999).

31. ***Carpinus purpurinervis*** Hu

Acta Phytotaxonomica Sinica 9: 293 (Hu 1964). – Type: China, Kwangsi [Guangxi], Du-an, in forests, 2 Jul. 1957, *Y.K. Li* [*Li Yin-kuen*/李荫昆] *P01567* (holo-: PE; iso-: IBK00190887!, IBK00190888!, IBK00190889!, IBK00190890!, IBK00190891!, IBSC0368220).

32. ***Carpinus putoensis*** W.C.Cheng

Contributions from the Biological Laboratory of the Science Society of China, Botanical Series 8: 72 (Cheng 1932). – Type: China, Zhejiang, [普陀区, 佛顶山/Putuo District, Fodingshan], 15 May 1930, *K.K. Tsoong* [钟观光] *94* (lecto-, designated here: PE00021950!; isolecto-: PE00021949!, PE00021951!).

33. ***Carpinus rankanensis*** Hayata

Icones Plantarum Formosanarum 6: 63, fig. 8 (Hayata 1916). – Type: R. China, [Taiwan, Yilan County], Rankanzan [Lan-K'an Shan, a mountain range NE of Nanao], 4000 ft, 12 May 1916, *B. Hayata* s.n. (lecto-, designated here: TI!; isolecto-: TAIF007302!, TAIF007303!, TAIF007304!).

33a. ***Carpinus rankanensis*** Hayata var. ***rankanensis***

33b. ***Carpinus rankanensis*** var. ***matsudae*** Yamam.

Supplementa Iconum Plantarum Formosarum 5: 15, fig. 5 (Yamamoto 1932). – Type: R. China, Taiwan, Ariko-banti, 8 Jul. 1917, *E. Matuda* [also called *Matsuda*] *11* (holo-: TAI118774!; iso-: TI!). – Note: this variety is accepted as a distinct variety of *C. rankanensis* in *Flora of China* (Li & Skvortsov 1999) but not by Liao (1996).

34. ***Carpinus rupestris*** A.Camus

Bulletin de la Société botanique de France 76: 966 (Camus 1930). – Type: s. loc., s. coll., eventually *J. Cavalerie 4560* (lecto-, designated here: P01903242!; isolecto-: P01903240!, P01903241!). – Additional type material: China, Kouy-tchéou [Guizhou], Houang-tia-pa [Houang-ts'ao-pa], grands rochers, *J. Cavalerie 4560* (syn-: A00033766!, E00240621!, K!); ibid., [Guizhou], Hin-y-hien [missionary station in SW of Guizhou, NW of Xingyi city, Hsien-i-fu, 興義府], rochers, *J. Cavalerie* s.n. (syn-: P01903239!). – Note: the specimen designated here as lectotype bears an annotation by Camus, so it is original material, but it lacks (as do the isolectotypes) an original label by Cavalerie. The specimen P01903242 bears a written note on an extracted page with the protologue that "*Cavalerie 4560*" is apparently missing in the Paris herbarium. Possibly, the original label became detached and is lost. The specimens P01903240–2 are not duplicates of the other syntype P01903239, which has male catkins and narrower leaves. In addition, P01903241 and P01903242 contain infrutescences.

35. ***Carpinus*** × ***schuschaensis*** H.J.P.Winkl.

Das Pflanzenreich IV 61 (Heft 19): 32 (Winkler 1904). – *C. betulus* [unranked] *schuschaensis* (H.J.P. Winkl.) Medw., *Vestnik Tiflisskogo Botanicheskogo Sada* 14: 33 (Medwedew 1909). – *C. betulus* f. *schuschaensis* (H.J.P.Winkl.) Radde-Fom., *Trudy fizychno-matematychnogo viddilu. Kiev* [*Mémoires de la Classe des Sciences Physiques et Mathématiques de l'Académie des Sciences de l'Ukraine*] 15 (1): 80 (Radde-Fomina 1929) comb. inval. pro syn. – Type: Karabagh, Schuscha, *R.F. Hohenacker* s.n. (syn-: B†, G-Boiss., W). – Note: Radde-Fomina published the combination *C. betulus* f. *schuschaensis* in synonymy, because she believed that Medwedew understood the name as a forma. However, Medwedew used the term "form" informally, as he used form (Medwedew 1909: 33) and variety (Medwedew 1909: 41) in parallel. His combinations are therefore unranked (Art. 37.8; McNeill *et al.* 2012). Biologically, this is a hybrid between *C. betulus* and *C. orientalis*.

C. × *grosseserrata* H.J.P.Winkl., *Das Pflanzenreich* IV 61 (Heft 19): 40 (Winkler 1904). – Type: Iran, bei Radkan, *F.A. Buhse 1043* (holo-: B†).

C. × *hybrida* H.J.P.Winkl., *Das Pflanzenreich* IV 61 (Heft 19): 40 (Winkler 1904). – Type: Transkaukasien, *R.F. Hohenacker* (syn-: B† and/or LE). Karabagh, s. coll., s.n. (syn-: B† and/or LE).

C. × *oxycarpa* H.J.P.Winkl., *Das Pflanzenreich* IV 61 (Heft 19): 31 (Winkler 1904). – *C. betulus* [unranked] *oxycarpa* (H.J.P. Winkl.) Medw., *Vestnik Tiflisskogo Botanicheskogo Sada* 14: 27 (Medwedew 1909). – *C. betulus* f. *oxycarpa* (H.J.P. Winkl.) Radde-Fom., *Trudy fizychno-matematychnogo viddilu. Kiev* [*Mémoires de la Classe des Sciences Physiques et Mathématiques de l'Académie des Sciences de l'Ukraine*] 15 (1): 83 (Radde-Fomina 1929) comb. inval. pro syn. – Type: Karabagh,

Schuscha, *R.F. Hohenacker*, U.i. 1838 (syn-: B†, G-Boiss.?, LE, Herb. Moritz Winkler, W†). – Note: Olga Radde-Fomina's combination in synonymy is a misunderstanding. She believed that Medwedew published a forma, but he used the term "form" informally, which is apparent in the index of his treatment, where he explicitly notes "var. *oxycarpa* (Winkl.) Medw." (Medwedew 1909: 41). Medwedew's combination is nevertheless to be regarded as unranked (Art. 37.8, McNeill *et al.* 2012). In contrast to Winkler's note (Winkler 1904), duplicates are not present in "Breslau" (Wrocław; BRSL or WRSL, pers. comm. K. Świerkosz).

C. × *oxycarpa* nothovar. *betuloides* H.J.P.Winkl., *Das Pflanzenreich* IV 61 (Heft 19): 32 (Winkler 1904). – Type: Karabagh, bei Schuscha, *R.F. Hohenacker*, U.i. *1838* (syn-: B†, G, LE).

C. × *geokczaica* Radde-Fom., *Trudy fizychno-matematychnogo viddilu. Kiev* [*Mémoires de la Classe des Sciences Physiques et Mathématiques de l'Académie des Sciences de l'Ukraine*] 15 (1): 89 (Radde-Fomina 1929). – Original citation: "Prov. Baku distr. Geokczai, in frutecetis siccis in ascensu as pagum Vaenk 1700'. 31 VII. 1899. Alexeenko (Herb. Acad. Petrop.) Prov. Baku distr. Schemacha, prope pagum Müdshi, in decliviis meridionalibus, in papidosis calcareis. 4000'. 30. VII. 1900. Alexeenko (Herb. Acad. Petrop.)". – Type: not localized.

36. ***Carpinus shensiensis*** Hu

Bulletin of the Fan Memorial Institute of Biology n.s. 1 (2): 145 (Hu 1948a). – Type: China, Shensi [Shaanxi], Yuan Kwan T'ang, mixed with *Celtis*, 15 Oct. 1935, *Y.Y. Pai 2891* (lecto-, designated here: PE00021952!; isolecto-: NAS00070315, WUK0072726). – Additional type material: China, Shaanxi, Hsing Lung Sze, 15 Oct. 1935, *Y.Y. Pai 2860* (para-: PE00802529!, WUK0072723, WUK0170781).

C. shensiensis var. *paucineura* S.C.Qu & K.Y.Wang, *Bulletin of Botanical Research, Harbin* 8 (4): 111 (Qu & Wang 1988). – Type: China, Shaanxi, Zhenping Xian, Feihe Xiang, Laoyachung, 1800 m a.s.l., Aug. 1986, *K.Y. Wang 747* (holo-: NWFC). – Additional type material: ibid., 1200 m a.s.l., *K.Y. Wang 740* (para-: not localized).

37. ***Carpinus shimenensis*** C.J.Qi

Journal of Nanjing Technological College of Forest Products 1981 (3): 123 (Qi 1981). – Type: China, Hunan, Shimen district, Huping shan, 2050 m a.s.l., *P.C. Cai* [*Cai Pingcheng*] *20241* (holo-: CSFI017382; iso-: NF). – Note: this name is accepted in the *World Checklist* (Govaerts & Frodin 1998), but it is not mentioned in the *Flora of China* (Li & Skvortsov 1999).

38. ***Carpinus tientaiensis*** W.C.Cheng

Contributions from the Biological Laboratory of the Science Society of China, Botanical Series 8: 135 (Cheng 1932). – *C. laxiflora* var. *tientaiensis* (W.C.Cheng) Hu, *Sunyatsenia* 1: 112 (Hu 1933). – Type: China, Zhejiang, Tiantai, Tien Tai Shan, open woods, 2800 ft, 12 Aug. 1927, *Y.L. Keng* [耿以礼] *1065* (lecto-, designated by Lin & Sun (2007: 178): PE00021959!; isolecto-: A00033765!, PE00021935!). – Additional type material: China, Zhejiang, Tiantai, Tientai Shan, in wood partially shaded, 3500 ft, 10 May 1924, *R.C. Ching 1547* (syn-: PE00021958!). – Note: the isolectotype from PE lacks a specimen label, but it has a collection label that matches the lectotype collection label exactly. It is therefore very likely a duplicate. However, it is annotated as "*Carpinus nobilis* Hu type", a name whose publication status is unknown to the present authors.

39. ***Carpinus tropicalis*** (Donn.Sm.) Lundell

Lloydia 2: 79 (Lundell 1939). – *C. americana* var. *tropicalis* Donn.Sm., *Botanical Gazette* 15: 28 (Smith 1890). – *C. caroliniana* var. *tropicalis* (Donn.Sm.) Standl., *Contributions from the United States*

National Herbarium 23 (1): 169 (Standley 1920). – Type: Guatemala, Alta Verapaz, Chicoyonito, 4300 ft, Apr. 1889, *J. Donnell Smith in Donn. Sm. Exs. Pl. cit. 1667* (lecto-, designated by Furlow (1987: 431): US00089312!; isolecto-: GH00033747!, K000512590!). – Additional type material: Guatemala, Alta Verapaz, bei Coban Tactic Purulá, 1250–1500 m a.s.l., May 1882, *F.C. Lehmann Pl. Guatemal., Costaric. Columbianae 1446* (syn-: BM000956101!, K!); ibid., Cumbre de Sta. Lucia, Jan. 1878, *K.G. Bernoulli* and *R. Cario Fl. Guatemal. 2606* (syn-: GOET!, K!); ibid., Las Majadas, May 1878, *K.G. Bernoulli* and *R. Cario Fl. Guatemal. 2607* (syn-: GOET!, K!).

39a. ***Carpinus tropicalis*** (Donn.Sm.) Lundell var. ***tropicalis***

39b. ***Carpinus tropicalis*** var. ***mexicana*** Furlow

Systematic Botany 12 (3): 431 (Furlow 1987). – Type: Mexico [México], [Jalisco], Municipio de Gómez Farias, Tamaulipas, camino al Rancho del Cielo, 1150 m a.s.l., 8 Aug. 1969, *H. Puig 5159* (holo-: ENCB). – Additional type material: Mexico [México], Cerro de Corona, Zacualpan, 2–3 May 1954, *E. Matuda et al. 30712* (para-: BH); ibid., Municipio de Ocuilan, cerca del Rio Chalma, Ahuehuete, 19 Sep. 1962, *May Nah AM-48* (para-: ENCB, MICH); ibid., 5 km al SW de Sultipec, sobre el camino a Amatepec, 2350 m a.s.l., 18 Feb. 1979, *J. Rzedowski 36059* (para-: ENCB, MICH); ibid., [Michoacán], Municipio de Pueblo Nuevo, ladera S del Volcán Tancitaro, 2000 m a.s.l., 19 Mar. 1977, *L.M.V. de Puga* and *S. Carvajal H. 10134* (para-: ENCB); ibid., Nuevo León, Dulces Nombres, 13 Jul. 1948, *F.G. Meyer* and *D.J. Rogers 2752* (para-: BM000956117!, E!, GH); ibid., Nuevo León, Municipio de Montemorelos, trail from La Trinidad to Sierra de la Cebolla, 20 Aug. 1939, *C.H. Muller 2867* (para-: GH).

40. ***Carpinus tsaiana*** Hu

Bulletin of the Fan Memorial Institute of Biology n.s. 1 (2): 141 (Hu 1948a). – Type: China, Yunnan, Ping-pien Hsien [屏边苗族自治县, 水塘坡, Pingbian Miao Autonomous County], 7 Jul. 1934, *H.T. Tsai 62398* (lecto-, designated here: PE00021960!; isolecto-: PE00021961!, PE00021962!). – Additional type material: ibid., 3 Jun. 1934, *H.T. Tsai 62191* (para-: LBG00053971, PE00802549!); ibid., Yunnan, Si-chou Hsien, Far-doe [西畴县, 法斗], 12 Dec. 1939, *C.W. Wang* [王启无] and *Y. Li* [刘瑛] *85686* (para-: PE00021918!, PE00021919!, PE00021920!, PE00802552!) [partly misspelled as 2 Dec. and 65686 but all with same label data]. – Note: *Carpinus tsaiana* Hu is accepted in the *Flora of China* (Li & Skvortsov 1999). The lectotype designated here is not the unpublished one, labeled as holotype. We deviate from the original intention, because the intended "holotype" has lost the fruits of its infructescence, therefore we choose a more complete specimen.

C. sichourensis Hu, *Bulletin of the Fan Memorial Institute of Biology n.s.* 1 (3): 214 (Hu 1949). – Type: China, Yunnan, Xichou [西畴县], Ma-chia, 14 Oct. 1947, *K.M. Feng 12516* (holo-: PE00802497!).

41. ***Carpinus tschonoskii*** Maxim.

Bulletin de l'Academie imperiale des sciences de St.-Pétersbourg 27: 534 (Maximowicz 1881b). – Type: Japan, [Kanagawa], Hakone, 1864, *S. Tschonoski* s.n. (syn-: LE; isosyn-: BM!, BR!, GH00033769 p.p.!, K000859942!, L! M-0265492!, P06809892!, P06811215!, P06809882!?, P06811396!?, P06809866!?, PE00021963 p.p.!, WU!); ibid., Fudzi-yama [Fuji yama], 1864, *S. Tschonoski* s.n. (syn-: LE; isosyn-: BM000580518!, GH00033769 p.p.!, K000859941!, P06811217!, PE00021963 p.p.!).

C. yedoensis Maxim., *Bulletin de l'Academie imperiale des sciences de St.-Pétersbourg* 27: 535 (Maximowicz 1881b). – Type: Japan, [Tokio,] cult. in Yedo [Edo, Tokio] Garden, Nov. 1862, *C.J. Maximowicz* s.n. (syn-: not localized); ibid., *L. Savatier 1172* (syn-: not localized).

C. fauriei Nakai, *The Botanical Magazine* [*Tokyo*] 26: 325 (Nakai 1912). – Type: South Korea, [Jeju], Quelpaert, in silvis, Oct. 1907, *E.-J. Taquet 587* (syn-: TI, KYO); ibid., Aug. 1911, *T. Mori 32* (syn-: TI); ibid., Aug. 1911, *T. Mori 33* (syn-: TI).

C. eximia Nakai, *Repertorium Specierum Novarum Regni Vegetabilis* 13: 249 (Nakai 1914). – *C. tschonoskii* var. *eximia* (Nakai) Hatus., *Bulletin of the Kyushu Imperial University Forests* 5: 48 (Hatushima 1934). – Type: South Korea, [Jeollanam-do], secus vias et in silvis circa templum Senonji pede montem Chirisan, 280 m a.s.l., 15 Jul. 1913, *T. Nakai 11* (holo-: TI). – Note: this name is accepted as a distinct species in the *World Checklist* (Govaerts & Frodin 1998), but listed as a synonym of *C. tschonoskii* in Chang *et al.* (2014a) and the WCSP (2016).

C. tschonoskii var. *jablonskyi* H.J.P.Winkl., *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 50 (Suppl.): 500 (Winkler 1914). – Type: Japan, prov. Kotzuke, Bamba und Nogurizawa, 29 Jul. 1894, *M. Shirai* s.n. (syn-: not localized); ibid., 1 Aug. 1894, *M. Shirai* s.n. (syn-: not localized). – Note: this name is mentioned neither in the *World Checklist* (Govaerts & Frodin 1998) nor in the WCSP (2016) nor in the *Flora of Japan* (Ohwi 1965). Chang *et al.* (2014a) list it as synonymous with *C. tschonoskii*.

C. tschonoskii var. *serratiauriculata* H.J.P.Winkl., *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 50 (Suppl.): 500 (Winkler 1914). – Type: Japan, [Tokyo,] Jedo, *L. Savatier 1172* (syn-: not localized); ibid., *L. Savatier* s.n. (syn-: not localized). Ibid., 1874, *L. Savatier* s.n. (syn-: P06811219!, P06810761!). – Note: this name is mentioned neither in the *World Checklist* (Govaerts & Frodin 1998) nor in the WCSP (2016) nor in the *Flora of Japan* (Ohwi 1965). Chang *et al.* (2014a) list it as synonymous with *C. tschonoskii*.

C. tschonoskii var. *subintegra* H.J.P.Winkl., *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 50 (Suppl.): 501 (Winkler 1914). – Type: South Korea, [Jeju], Insel Quelpart, Hallaisan [Hallasan mt.], Jul. 1907, *U.J. Faurie 1535* (holo-: not localized; iso-: A00033735!, BM!, E00388827!, P06809858!). – Note: this name is not mentioned in the *World Checklist* (Govaerts & Frodin 1998), while Chang *et al.* (2014a) list it as synonymous with *C. tschonoskii*.

C. tschonoskii var. *brevicalycina* Nakai ex Kawamoto, *Handbook of Korea-Manchurian Forestry*: 92 (Kawamoto 1939). – Type: not localized. – Note: this name is not mentioned in the *World Checklist* (Govaerts & Frodin 1998) nor in the WCSP (2016). Jeon & Chang (1997) consider it as a synonymous with *C. tschonoskii*, Chang *et al.* (2014a) list it as a invalid name. The present authors did not see the protologue, so validity of the name is unclear.

C. coreensis Koidz., *Acta Phytotaxonomica et Geobotanica* 9 (2): 73 (Koidzumi 1940). – Original citation: "*Carpinus fargesiana* (non Winkl.) Nakai Fl. Sylv. Korea. II (1915). […] Korea: mt. Chiisan, Hannyaho, Kokiri". – Type: not localized. – Note: Jeon & Chang (1997) and Chang *et al.* (2014a) consider this name to be synonymous with *C. tschonoskii*, as it is listed in the *World Checklist* (Govaerts & Frodin 1998).

C. tschonoskii f. *pendula* Hayashi, 林業試験場研究報告 [*Research Report of the Forestry Experiment Station*] 125: 72 (Hayashi 1960). – Type: Japan, Hondo, prov. Mushi, Kokubunji, 10 May 1958, *Y. Hayashi* s.n. (holo-: TFM). – Note: this name is not mentioned in the *World Checklist* (Govaerts & Frodin 1998) or in the *Flora of Japan* (Ohwi 1965). Most likely, this is to be regarded as a cultivar with hanging branches rather than as a botanical taxon.

C. mianningensis T.P.Yi, *Bulletin of Botanical Research, Harbin* 12 (4): 335 (Yi 1992). – Type: China, Sichuan, Mianning County, Lingshan, 18 Jul. 1991, *T.P. Yi* [易同培] *91170* (holo-: SIFS; iso-: PE00934231!). – Note: this name is accepted in the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012), but it is listed as synonymous with *C. tschonoskii* in the *Flora of China* (Li & Skvortsov 1999).

41. ***Carpinus turczaninovii*** Hance

Journal of the Linnean Society, Botany 10 (44): 203 (Hance 1868). – Type: China, in collibus ad occidentem urbis Peking [Beijing] sitis, Aug. 1865, *S.W. Williams 12681* (holo-: K000859937!). – Additional original material: China, in collinis Pekinensibus, Aug. 1865, *S.W. Williams 12681* (BM000580390!). – Additional original material?: China, in ditione Pekinensis, Aug. 1866, *S.W. Williams 12681* (GH00112537!, LE). – Note: several gatherings are distributed with the number *12681*, all belonging to the same species. Winkler (1914: 502) already mentions the admixed nature of the specimens with the same "collection" number. Hance cited "collibus ad occidentem urbis Peking, m. Augusto 1865," which is only written on the specimen K000859937, which is therefore the holotype. However, the other specimens seen by the present authors were distributed from Hance's collection, so they are original material.

C. paxii H.J.P.Winkl., *Das Pflanzenreich* IV 61 (Heft 19): 35 (Winkler 1904). – Type: China, Peking, Tse-tai-ssu, *H. Wawra von Fernsee 1067* (syn-: B†, W†; isosyn-: A00033761!). – Note: Winkler (1914: 502) acknowledged C.K. Schneider's comment that his *C. paxii* is synonymous to *C. turczaninovii*. This name is not mentioned in the *Flora of China* (Li & Skvortsov 1999), but it is listed as synonym of *C. turczaninovii* in the *Flora of Japan* (Ohwi 1965) and in the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012).

C. stipulata H.J.P.Winkl., *Das Pflanzenreich* IV 61 (Heft 19): 35 (Winkler 1904). – *C. turczaninovii* var. *stipulata* (H.J.P.Winkl.) H.J.P.Winkl., *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 50 (Suppl.): 505 (Winkler 1914). – Type: China, Schensi [Shaanxi], C-China, im Tsin-ling-shan-Gebirge, 10 Jul. 1900, *G.* [*Giuseppe*, but also called *Joseph*; *Reverend*] *Giraldi 7267* (lecto-, designated here: K000859930!; isolecto-: A00077468!, B†). – Note: this name is listed as a synonym of *C. turczaninovii* in the *Flora of Japan* (Ohwi 1965), but it is accepted as a distinct species in the *Flora of China* (Li & Skvortsov 1999).

C. tanakaeana Makino, *The Botanical Magazine* [*Tokyo*] 28: 32 (Makino 1914). – Type: Japan, Tokushima, prov. Tosa, Mt. Yokogura (on limestone), *T. Makino* s.n. (holo-: MAK046499!).

C. turczaninovii var. *makinoi* H.J.P.Winkl., *Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie* 50 (Suppl.): 505 (Winkler 1914). – Type: Japan, prov. Tosa, 1889, *T. Makino 277* (syn-: not localized); ibid., s. loc., *M. Shirai* s.n. (syn-: not localized). – Note: this name is not listed in the *World Checklist* (Govaerts & Frodin 1998) or in the WCSP (2016), but listed as a synonym of *C. turczaninovii* in the *Flora of Japan* (Ohwi 1965).

C. coreana Nakai, *The Botanical Magazine* [*Tokyo*] 40: 162 (Nakai 1926). – *C. turczaninovii* var. *coreana* (Nakai) W.T.Lee, *Lineamenta Florae Koreae* 166 (Lee 1996). – Type: South Korea, [Jeollanam-do], in monte Kannonzan insl. Wangto, 20 Jun. 1913, *T. Nakai 581* (holo-: TI). – Additional type material: South Korea, [Incheon], prov. Keiki, Chemulpo [Jemulpo], in horto residentis germanici, Sep. 1906, *U.J. Faurie 202* [cited as *E. Taquet 202*] (para-: BM000580428, E00275514!, P05591545!); ibid., [Jeollanam-do,], prov. Zennan, monte Yudalsan [mt.], Mokpo [city near Yudalsan], *T. Nakai 9377* (para-: not localized); ibid., [Jeollanam-do], in silvis Genkeimen, *T. Nakai 9378* (para-: not localized); ibid., [Jeollanam-do], in monte insl. Chito, *T. Nakai 9379* (para-: not localized); ibid., [Jeollanam-do], in silvis montis Semsatsuzan insl. Chinto [Jindo], *T. Nakai 9381* (para-: not localized); ibid., [Jeollanam-do], in silvis insl. Baikato, *T. Ishidoya* and *Chung 3382* (para-: not localized); ibid., [Jeollanam-do], in monte Monganzan insl. Daikokuzanto, *T. Ishidoya* and *Chung 3384* (para-: not localized); ibid., [Jeju,] Quelpaert [Jeju-do]: in silvis, *E. Taquet 6220* (para-: not localized); ibid., [Jeollanam-do], Kantoku, *T. Nakai 1439* (para-: not localized); Japan, [Nagasaki], Tsusima [Tsushima] in monte Sumo-shiratake, *T. Nakai* s.n. (para-: not localized). – Note: *Carpinus coreana* is cited as a distinct species in the *World Checklist* (Govaerts & Frodin 1998), but listed as a synonym of *C. turczaninovii* in WCSP (2016). Nakai described his new species by using the differences of some Korean specimens that had been discussed by Winkler (1914) as being similar to *C. turczaninovii*, but not typical. Sun *et al.* (2011) used three accessions in their phylogeny and

found one to be almost inseparable from *C. turczaninovii* [*Lee* s.n. (SKK); Yoo & Wen (2002)], and two being closely related to *C. fangiana* and *C. japonica*. Although the three accessions could not be examined, it is likely that the first one concerns *C. coreana*. For the two other accessions no specimen is cited, but they were discussed by Sun *et al.* (2011) as differing by "long hairs on the mid vein, inflorescences, and leaf margin veins". The placement in the phylogeny, however, rather suggests that those specimens belong to the *Distegocarpus* group, and hence might be misidentified *C. japonica* or *C. cordata*.

C. coreana var. *major* Nakai, *The Botanical Magazine* [*Tokyo*] 40: 162 (Nakai 1926). – Type: South Korea, [Hwanghae-namdo], Yooshin, prov. Kokei, *T.H. Chung* [*Chung-tyai-hyon*] s.n. (holo-: TI). – Note: according to the diagnosis, the large leaf and bract size rather suggest stronger affinities to *C. tschonoskii* than to *C. turczaninovii*, however this remains speculative without having examined the type. Jeon & Chang (1997), Chang *et al.* (2014a) and the WCSP (2016) consider this to be a synonym of *C. turczaninovii*.

C. chowii Hu, *Journal of the Arnold Arboretum* 13: 333 (Hu 1932). – Type: China, Hopei, Fang-shan, 500 m a.s.l., 5 Oct. 1931, *H.F. Chow 41730* (lecto-, designated here: PE00021883!; isolecto-: A00033750!, PE00021884!, PE00802985!).

C. coreana var. *multiflora* Nakai ex Kawamoto, *Handbook of Korea-Manchurian Forestry*: 92 (Kawamoto 1939). – Type: not localized. – Note: this name is neither mentioned in the *World Checklist* (Govaerts & Frodin 1998) nor in the *Flora of China* (Li & Skvortsov 1999) or the WCSP (2016). Jeon & Chang (1997) consider is to be synonymous with *C. turczaninovii*, Chang *et al.* (2014a) list it as invalid name. The present authors did not have the protologue at hand for verification.

C. turczaninovii var. *arguta* Uyeki, *Woody-Plants and their Distributions in Tyôsen*: 16 (Uyeki 1940). – Type: not localized. – Note: this name is not mentioned in the *World Checklist* (Govaerts & Frodin 1998) or the WCSP (2016), but Chang *et al.* (2014a) list it as a invalid name. The present authors did not see the protologue to confirm this.

C. turczaninovii var. *chungnanensis* P.C.Kuo, *Flora Tsinlingensis* 1 (2): 601 (Instituto Botanico Boreali-occidentali Academiae Sinicae Edita 1974). – Type: China, Shaanxi, Chang-an Hsien [终南山, Chung-nan-shan; Zhongnanshan], 1700 m a.s.l., 15 Jun. 1933, *H.W. Kung 2838* (holo-: WUK0000756, WUK0000764). – Note: if necessary, the lectotype should be chosen from one of the two cited specimens, because the *Flora Tsinlingensis* is mainly based on material from WUK. As there is no image of the specimens available to the present authors, the designation of a lectotype here does not seem to be appropriate.

43. ***Carpinus viminea*** Lindl.

Plantae Asiaticae Rariores 2: 4 (Wallich 1831). – Type: India, in Kamaon, *R. Blinkworth* in N. Wallich list no. *2800b* (lecto-, designated here: K001117116!; isolecto-: BM000580526!). – Additional type material: Nepal, in montibus Napaliae, N. Wallich list no. *2800a* (syn-: BM000580527!, E00301177!, E00301178!, K001117115!, K000859917!, K000859918!, M!); India, Sirmore [Sirmaur], *W.A. Webb* s.n. (syn-: not localized). – Note: it is accepted in *Flora of China* (Li & Skvortsov 1999) with *C. viminea* var. *chiukiangensis* as a distinct variety. The Kew specimen K000859918 bears a note "Napalia Wallich 1830" but Wallich was in Nepal in 1821 (Wallich list no. 2800a). Most likely, the number has to be regarded as the year when the specimen was received at Kew.

C. laxiflora var. *macrostachya* Oliv., *Icones Plantarum* 20 (4): tab. 1989 (Oliver 1891). – *C. macrostachya* (Oliv.) Koidz., *Acta Phytotaxonomica et Geobotanica* 9 (2): 73 (Koidzumi 1940). – Type: China, Hupeh, North Patung, *A. Henry 7013* (lecto-, designated here: K000859943!; isolecto-: BM!, E!, P06811517!). – Note: this name is treated as a synonym of *C. viminea* var. *viminea* in the *Flora of China* (Li & Skvortsov 1999) and the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012).

C. laxiflora var. *davidii* Franch., *Journal de Botanique* [*Morot*] 13: 203 (Franchet 1899). – *C. davidii* (Franch.) C.K.Schneid., *Illustriertes Handbuch der Laubholzkunde* 2: 893 (Schneider 1912). – Type: China, China centralis, prov. Kiukiang, in montibus Ly chan, Sep. 1868 [*Reverend Père, J.P.*] *A. David 750* (lecto-, designated here: P06811502!; isolecto-: P06811505!, P06811506!, P06811507!). – Note: this name is treated as a synonym of *C. viminea* var. *viminea* in the *Flora of China* (Li & Skvortsov 1999) and the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012).

C. fargesii Franch., *Journal de Botanique* [*Morot*] 13: 202 (Franchet 1899). – *C. laxiflora* var. *fargesii* (Franch.) Burkill, *Journal of the Linnean Society, Botany* 26 (178): 501 (Forbes & Hemsley 1899). – Type: China, Sutchuen [Sichuan], in ditione Tchen keou tin [Chengkou County], *P.G.* [*Reverend Père*] *Farges 699* (holo-: P06811515!; iso-: NY00253861!). – Note: this name is treated as a synonym of *C. viminea* var. *viminea* in the *Flora of China* (Li & Skvortsov 1999) and the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012).

C. kenpukwan Koidz., *Acta Phytotaxonomica et Geobotanica* 9 (2): 74 (Koidzumi 1940). – Type: [China, China centralis] Hu & Chun (1927: 15, tab. 15) [*tabula*, *sub C. laxiflora* (Siebold & Zucc.) Blume]. – Note: this name is mentioned neither in the *Flora of China* (Li & Skvortsov 1999) nor in the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012).

C. tehchingensis Hu, *Acta Phytotaxonomica Sinica* 9: 283 (Hu 1964). – Type: China, Yunnan, Tehchin Hsien, Sila, in mixed woods, 2700–2900 m a.s.l., 18 Jul. 1944, *K.M. Feng* [冯国楣] *5593* (holo-: PE00021957!). – Note: this name is also synonymous with *C. viminea* var. *viminea* according to the *Flora of China* (Li & Skvortsov 1999) and the *Flora Sichuanica* (Editorial Board of the Flora Sichuanica 2012).

C. viminea var. *chiukiangensis* Hu, *Acta Phytotaxonomica Sinica* 9: 282 (Hu 1964). – Type: China, Yunnan, Chiukiang valley, in wood, 1950 m a.s.l., 31 Jul. 1938, *T.T. Yü 19531* (lecto-, designated here: PE00802369!; isolecto-: A00033771!, E!, PE00802338!, PE00802368!). – Note: this name is accepted as distinct variety of *C. viminea* in *Flora of China* (Li & Skvortsov 1999).

C. fargesii var. *latifolia* S.Y.Wang & C.L.Chang, *Journal of the Henan Agricultural College* 14 (2): 6 (Ding *et al.* 1980). – Type: China, Henan, Luanchuan (栾川), 12 Aug. 1978, *S.Y. Wang et al.* [王遂义等] *78 0346* (holo-: HEAC).

Invalid names

C. betulus var. *marmoratus* de Vos, *Beredeneerd woordenboek der voornaamste heesters en coniferen, in Nederland gekweekt*: 21 (Vos 1867) nom. nud. – Note: the name by de Vos lacks a valid description, so it is to be ignored under the ICN rules (McNeill *et al.* 2012) but available as a cultivar name (Art. 21.6. ICNCB, Brickell *et al.* 2009): *C. betulus* 'Marmorata'. According to Krüssmann (1951), the name was also published in a Späth garden catalogue, but these were not at hand to the present authors for the verification of the validity.

C. albopilosa Hu nom. nud. – Note: no publication of this name is known, name only written on the specimen PE00020172! (China, Sichuan, Leibo County, 1934, *W.Y. Chun 3942*).

C. calcarea W.C.Cheng nom. nud. – Note: this name is only written on a specimen (China, *Metasequoia* Area, Hubei-Sichuan, 1948 m a.s.l., *W.C. Cheng* and *C.T. Hwa 866*: A00033749!, K!). A duplicate in HIB (HIB0156026) is stored as *Ostrya japonica*. The specimen was also cited under the apparently invalid name *C. whilungpaensis* W.C.Cheng.

C. cambodica L.Pierre nom. nud. – Note: apparently an unpublished name. The specimens are stored in P herbarium, P06811149!, P06811167! and P06810780! (Vietnam, crescit ad montem Chiao shan in Cochinchina, Feb. 1877, *L. Pierre 3300*), under *C. poilanei* A.Camus (synonymous to *C. londoniana* H.J.P.Winkl. var. *londoniana*).

C. changhwaensis Hu nom. nud. – Note: no publication of this name known, only written on the specimen PE00020179! (China, Zhejiang, Linan, 8 May 1929, s. coll. *363*).

C. japonica var. *auricula* Maxim. nom. nud. – Note: this name is only listed on written specimens BM000580481!, BR! and K! (Japan, Yokohama, 1862, *C.J. Maximowicz* s.n.).

C. laifengensis Wuzhi nom. nud. – Note: apparently an unpublished herbarium name, mentioned in Chen (2015).

C. mexicana Griseb. nom. nud. – Note: this name is only written on a specimen in GOET! (Mexico, *W. Schaffner Pl. Mexicanae* no. 14) and on two specimens in P, P06810806! (Mexico, *W. Schaffner Pl. Mexicanae* no. 14) and P06810805! (Mexico, in montanis mexique Orizaba, *M.B.* [*M. Botteri*?]). Despite having the same name, but at a different rank, Furlow (1987) does not mention the apparently unpublished Grisebach name.

C. microbracteata Hu nom. nud. – Note: there is no publication with this name known to the present authors; it is only written on the specimens BM! and PE00818273! (China, Sichuan, Baoxing, 1900 m a.s.l., 11 Sep. 1936, *K.L. Chu* [曲桂龄] *3824*).

C. tatarinowii Hance nom. nud. – Note: there is no publication with this name known to the present authors; it is only written on the specimens P06811225! and P06811224! (China, ad Pekinum [giulles], *P.G.* [*Reverend Père*] *Farges* s.n.).

Checklist of Ostrya

Order Magnoliales Juss. ex Bercht. & J.Presl
Family Betulaceae Gray
Subfamily Coryloideae Hook.f.
Tribe Carpineae A.DC.

Ostrya Scop.

Flora Carniolica: 414 (Scopoli 1760) nom. cons. – Type: *Ostrya carpinifolia* Scop. – Note: the name was conserved against *Ostrya* J.Hill (Hill 1757: 513) ["1756"], which is a publication of a superfluous name for *Carpinus* L.

1. ***Ostrya carpinifolia*** Scop.

Flora Carniolica ed. 2, 2: 244 (Scopoli 1772). – *O. carpinifolia* var. *genuina* Fliche, *Bulletin de la Société botanique de France* 35: 166 (Fliche 1888) nom. inval. (although not explicitly cited but in context including the type, see Art. 24.3, McNeill *et al.* 2012). – *O. italica* subsp. *carpinifolia* (Scop.) H.J.P.Winkl., *Das Pflanzenreich* IV 61 (Heft 19): 22 (Winkler 1904). – *Carpinus ostrya* L., *Species Plantarum*: 998 (Linnaeus 1753) p.p. – Original citation: "Italia, Virginia." – Type: s. loc., s. coll. (lecto-, designated by Iamonico & Reveal (2012: 866): LINN! ex herb. Linn. no. 1131.4). – Additional original material: S.d. (BM000647418! ex herb. Clifford 447, *Carpinus* 2).

O. vulgaris Willd., *Species Plantarum ed. 4*, 4 (1): 469 (Willdenow 1805) nom. illegit. superfl. – Note: Willdenow cites *O. carpinifolia* as synonym, so his name is superfluous.

O. italica P.Micheli ex Spach, *Annales des sciences naturelles, Botanique ser. 2* 16: 246 (Spach 1841b) nom. illegit. superfl. – *O. italica* Scop., *Flora Carniolica*: 414 (Scopoli 1760) nom. inval. (polynomen), pro syn. – *Carpinus italica* Steud., *Nomenclator Botanicus ed. 2*, 1: 300 (Steudel 1841) nom. inval. pro syn. – *O. ostrya* var. *italica* (P.Micheli ex Spach) C.K.Schneid., *Illustriertes*

Handbuch der Laubholzkunde 1: 143 (Schneider 1904) nom. inval. (tautonym). – Note: *Ostrya italica* Scop. is rather a misinterpretation as Scopoli discusses only genera and as he did not adopt Linnaeus' binomials in this work. Scopoli's name might better be read as polynomial "Ostrya Italica, Carpini folio liongiore &? breviore." that he took from Micheli (1729: 223) as one of the names used for the genus *Ostrya*. Spach accepted *O. italica* in 1841, but he cited *O. carpinifolia* in synonymy. One year later, Spach refers to the species as *O. vulgaris* Willd. Steudel refers to an unpublished name, or used by Scopoli, "*Carpinus italica*" (or mistaken by Steudel) as a synonym of *O. vulgaris*.

O. cylindrica Friv., *A'Magyar Tudós Társaság Évkönyvei* 3 (3): 163 (Frivaldszky von Frivald 1837) nom. nud. – Note: the name also appears on a specimen (WU!) from Macedonia.

O. carpinifolia var. *alpestris* Ces., *Saggio su la Geografia botanica e su la Flora della Lombardia*: 61 (Cesati 1844). – Type: not localized (RO?). – Note: There is a specimen by Cesati from Varenna, Lombardy, Italy (P06751764!). It was annotated by him as "*Ostrya carpinifolia* β *collina mihi*". Eventually, Cesati changed his mind about the epithet upon publication of his new variety.

O. ladelcii Sanguin., *Flora Romanae Prodromus Alter*: 818 (Sanguinetti 1864). – Original citation: "In sylvaticis Latii, Frascati, Albano." – Type: not localized (RO?).

O. carpinifolia var. *corsica* Fliche, *Bulletin de la Société botanique de France* 35: 166 (Fliche 1888). – Type: France, Corsica, forêt communale de Pietrosa, May 1885, *P. Fliche* s.n. (syn-: not localized). France, Corsica, forêt de Tova, May 1885, *P. Fliche* s.n. (syn-: not localized); ibid., forêt de Bavella, *Mathieu* s.n. (syn-: not localized); ibid., plateau de Nebbio, *Mathieu* s.n. (syn-: not localized).

O. carpinifolia var. *lanceolata* Kem.-Nath., *Trudy Tbilisskogo Botaniceskogo Instituta* 2: 131 (Kemularia-Nathadze 1937). – Type: Georgia, prov. Kutais, distr. Letschchum, fauces fl. Ladjanura loc. Orpiri, prope pag. Atscharis-chidi ad rupes calcareas, 22 May 1929, *L.M. Kemularia-Nathadze* s.n. (syn-: not localized); ibid., 19 Oct. 1932, *L.M. Kemularia-Nathadze* s.n. (syn-: not localized).

2. ***Ostrya chinensis*** I.M.Turner

Annales Botanici Fennici 51: 308 (Turner 2014). – *O. multinervis* Rehder, *Journal of the Arnold Arboretum* 19: 71, pl. 217 (1938) nom. illegit., non Ettingshausen (1868) (later homonym). – Type: China, Hunan, Ma-ling-tung, Sinning Hsien, in mixed forest on slope, 650 m a.s.l., 13 Oct. 1935, *C.S. Fan* and *Y.Y. Li 605* (holo-: A00033789!; iso-: BM001191567!, NAS00286610!, L!, P06811043!).

3. ***Ostrya japonica*** Sarg.

The Silva of North America 9: 32 (Sargent 1896). – *O. ostrya* var. *japonica* (Sarg.) C.K.Schneid., *Illustriertes Handbuch der Laubholzkunde* 1: 143 (Schneider 1904) nom. inval. (tautonym). – Type: Japan, Hokkaido, Hill near Sapporo, 18 Sep. 1892, *C.S. Sargent* s.n. (syn-: GH00055441!); ibid., Oiwagi, 1861, *C.J. Maximowicz* s.n. (syn-: BM!, BR!, K000859914!, L!, M-0265487!, P06809338!, P06811038!, W1886–1595!); ibid., Nambo, 1865, *S. Tschonoski* s.n. (syn-: K0000859913!, P06811037!); ibid., in sylvis frondosis circa lacum Konoma (syn-: not localized); cult. in Arnold Arboretum from seeds sent from Japan by H. Mayr (syn-: not localized). – Note: the name *O. japonica* Sarg. was only accepted by the author in the 1896 publication. Before, Sargent (1893, 1894) initially expressed certainty on the distinctness "In the forests of Yezo I felt no doubt of its specific distinctness […] all, things considered, it is, perhaps, best to consider the Japanese tree as specifically distinct". However, just in the next sentence, he weakened his opinion stating "Only after it has been grown here during many years side by side with the American species will it be possible to reach any opinion on this subject worthy of much consideration. If it proves to be distinct it should bear the name of *Ostrya Japonica*". According to Art. 36.1. b (McNeill *et al.* 2012), the two early publications (Sargent 1893, 1894) cannot be considered as a valid publication of *O. japonica*. In 1896, however, Sargent accepted the Japanese collections as fully distinct and formalized the name.

O. carpinifolia f. *japonica* Schelle, *Handbuch der Laubholzbenennung*: 49 (Beissner *et al.* 1903) nom. nud.

O. liana Hu, *Journal of the Arnold Arboretum* 11: 49 (Hu 1930). – Type: China, Chihli, eastern tomb, 15 Sep. 1929, *C.F. Li* timber no. *3* [field no. *3*, Herbarium number *15*] (lecto-, designated here: PE00021986!; isolecto-: A00033788!).

O. japonica var. *homochaeta* Honda, *The Botanical Magazine* [*Tokyo*] 47: 433 (Honda 1933). – Type: Japan, Honshu, Nikko, prov. Shimotsuke, 1889, *M. Shirai* s.n. (holo-: TI). – Additional type material: ibid., 1931, *H. Itoo* s.n. (para-: not localized); ibid., prov. Bicchu, Takahashi, 1915, *G. Koidzumi* s.n. (para-: not localized); ibid., Hokkaido, in monte Moiwa, circ. Sapporo, 1893 *G. Yamada* (para-: not localized); South Korea, [Seogwipo,] in monte Hallaisan, ins. Saishuutoo, 1917, *E.J. Taquet 4439* (para-: E00388817); ibid., [Jeju,] ins. Saishuto [Jeju-do, Quelpaert], 1917, *T. Nakai 4905* (para-: not localized); ibid., [Haenam], in monte Daikoji, prov. Zenra-nandoo, 1921, *T. Nakai 9384* (para-: not localized).

O. virginica var. *japonica* Sarg., *Garden and Forest* 6: 383 (Sargent 1893) nom. nud. – Note: Sargent wrote that Maximowicz (1881a) had named the Japanese *Ostrya* collections as var. *japonica*, but there is no such name mentioned in the cited Maximowicz paper.

4. ***Ostrya knowltonii*** Coville

Garden and Forest 7: 114 (Coville 1894). – *O. carpinifolia* f. *knowltonii* (Coville) Schelle, *Handbuch der Laubholzbenennung*: 49 (Beissner *et al.* 1903). – Type: USA, Arizona, Yavapai Co., Grand Canon of the Colorado River, 10 Jul. 1892, *J.W. Toumey 272* (holo-: US00130392!; iso-: A00263686!).

O. baileyi Rose, *Contributions from the United States National Herbarium* 8 (4): 293 (Rose 1905). – Type: USA, Texas, Guadalupe Mountains, 19 Aug. 1901, *V. Bailey 435* (holo-: US00089317!).

O. chisosensis Correll, *Wrightia* 3 (7): 128 (Correll 1965). – *O. knowltonii* subsp. *chisosensis* (Correll) A.E.Murray, *Kalmia* 12: 22 (Murray 1982). – *O. knowltonii* var. *chisosensis* (Correll) A.E.Murray, *Kalmia* 13: 10 (Murray 1983). – *Ostrya virginiana* var. *chisosensis* (Correll) Henrickson ex A.M.Powell, *Trees and Shrubs of the Trans-Pecos and Adjacent Areas*: 75 (Powell 1998). – Type: USA, Texas, Brewster Co., Chisos Mts, Big Bend NP, base of north-facing ledges, Emory Peak, 17 Jun. 1964, *D.S. Correll 29733* (holo-: LL00370396!; iso-: C10009751!, GH00033786!, LL00370395!, MEXU00122440!, MEXU00711117!, MICH1192171!, NCU00000363!, TEX, US00089316!). – Additional type material: USA, Texas, high shady crevice in rock bluff, near Nail place, Chisos Mts., 21 Aug. 1915, *M.S. Young* s.n. (para-: SRSC3716!, TEX00378112); ibid., north of Crown Mt, Chisos Mts, 1 Jul. 1937, *B.H. Warnock 21633* (para-: SRSC3715!, SRSC3721!, TEX00378110); ibid., igneous soil on Emory-Boot trail, Big Bend NP, Chisos Mts, 7500 ft, 8 Jun. 1952, *B.H. Warnock 10478* (para-: LL00378111, SRSC3718!); ibid., along a trail from Boot Spring and Basin, Chisos Mts, north side of emory Peak, Big Bend NP, 15 Jul. 1955, *B.H. Warnock 12726* (para-: LL00378109, SRSC3714!). – Note: *Ostrya chisosensis* was recognized in *Flora of North America* (Furlow 1997). However, its taxonomic status has been challenged recently (McCauley & Paces 2015).

5. ***Ostrya rehderiana*** Chun

Journal of the Arnold Arboretum 8 (1): 29 (Chun 1927). – Type: China, Tien Moh Shan, 400 m a.s.l., fairly common in open woods, 2 Oct. 1925, *R.C. Ching 3385* (lecto-, designated here: A00033790!; isolecto-: N, US00089314!).

6. ***Ostrya trichocarpa*** D.Fang & Y.S.Wang

Guihaia 3 (3): 189 (Fang & Wang 1983). – Type: China, Guangxi, Napo County (那坡县), 百都公社, 弄化, 1260 m a.s.l., 石山 [rocky hill], 23 Apr. 1981, *D. Fang, T.-H. Tan* and *Z.-G. Wang* [方鼎, 覃

德海, 王振刚] *22412* (holo-: GXMI050301). – Additional type material: ibid., *D. Fang, M.-X. Lai et al. 25379* (para-: GXMI); ibid., Guanxi Zhuang Auton. Region, Jinxi County, 780 m a.s.l., 17 Nov. 1962, *Z.-J. Li* and *H.-Q Li 1650* (para-: IBK00079836!, IBK00079837!).

7. ***Ostrya virginiana*** (Mill.) K.Koch

Dendrologie 2 (2): 6 (Koch 1873). – *Carpinus virginiana* Mill., *The Gardeners Dictionary ed. 8*, no. 6 (Miller 1768). – *Zugilus virginica* Raf., *Florula Ludoviciana*: 159 (Rafinesque 1817) orth. var., nom. illegit. superfl. – *O. ostrya* var. *virginiana* (Mill.) C.K.Schneid., *Illustriertes Handbuch der Laubholzkunde* 1: 143 (Schneider 1904) nom. inval. (tautonym). – Type: [Cult. garden specimen], 1740, *Chelsea Physic Garden 938* (lecto-, designated by Reveal (1990): BM001041898!). – Note: in his protologue, Miller only cited a Plukenet (1692) drawing, which does not correspond well to what is today considered as *O. virginiana*. Reveal (1990) found a matching typotype (H.S. 95:143, BM-SL) that turned out to be *O. carpinifolia* Scop., and three specimens from that era that Miller might have had seen (but without actual evidence) of what is now considered *O. virginiana*. Nevertheless, the proposal to conserve the name with a new type was rejected, and it was decided that one of the specimens should serve as lectotype (Brummitt 1993).

7a. ***Ostrya virginiana*** (Mill.) K.Koch subsp. ***virginiana***

Carpinus virginica Münchh., *Der Hausvater* 5 (1): 120 (Münchhausen 1770) orth. var. – *O. carpinifolia* var. *virginica* (Münchh.) Fliche, *Bulletin de la Société botanique de France* 35: 166 (Fliche 1888). – Note: Münchhausen misspelled the name given by Miller.

Carpinus triflora Moench, *Methodus*: 694 (Moench 1794). – Type: not localized. – Note: the protologue does not state any locality, and Moench's herbarium is destroyed (Stafleu & Cowan 1976–1988).

O. americana F.Michx., *Histoire des Arbres Forestiers de l'Amérique Septentrionale* 3 (1): 54 (Michaux 1812) nom. inval. – Associated material: A Canada ad Carolinam montosam, s. coll., s.n. (P06810885!). – Note: while Michaux briefly mentions an "*Ostrya americana*", he apparently does not consider it to be a species different from "*Carpinus ostrya*" (*Ostrya carpinifolia*). The name is not mentioned in the index either, so the name is rather to be interpreted as meaning the plants from America. The associated material by Michaux also suggests that.

O. virginica var. *eglandulosa* Spach, *Annales des sciences naturelles, Botanique ser. 2* 16: 246 (Spach 1841b). – Type: Cult. at Trianon Garden, 1833, s. coll., s.n. (lecto-, designated here: P06811525!). – Note: the specimen designated as lectotype here bears a note by Spach as author "Nob." after the name.

O. virginica var. *glandulosa* Spach, *Annales des sciences naturelles, Botanique ser. 2* 16: 246 (Spach 1841b). – *O. virginiana* var. *glandulosa* (Spach) Sarg., *Botanical Gazette* 67: 216 (Sargent 1919). – *O. virginiana* f. *glandulosa* (Spach) J.F.Macbr., *Publications of the Field Museum of Natural History, botanical series* 4 (7): 192 (MacBride 1929). – Type: Cult. at h. P. [*hortus Parisiensis*], 1833, s. coll., s.n. (lecto-, designated here: P06809319!). – Note: the specimen designated as lectotype here bears a note by Spach as author "Nob." after the name.

O. ostrya (L.) MacMill., *The Metaspermae of the Minnesota Valley*: 287 (MacMillan 1892) nom. inval. (tautonym), p.p. – Note: MacMillan referred only to the Virginian part of Linnaeus' *Carpinus ostrya* L., but he produced a tautonym, which is not valid according to Art. 23.4 of the ICN (McNeill *et al.* 2012).

O. virginiana var. *lasia* Fernald, *Rhodora* 38: 414 (Fernald 1936). – *O. virginiana* subsp. *lasia* (Fernald) A.E.Murray, *Kalmia* 12: 22 (Murray 1982). – Type: USA, Florida, Columbia Co., Lake City, 11–19 Jul. 1895, *G.V. Nash 2158* (holo-: GH00033787!; iso-: E00870598!, K!, P06810598!, P06810607!, US00089313!, WU!). – Additional type material: USA, Virginia, Henrico Co., Richmond, 5 May 1894, *J.R. Churchill* s.n. (para-: not localized); ibid., Princess Anne Co., rich dry woods, Little Neck,

M.L. Fernald et al. 4627 (para-: not localized); ibid., Norfolk Co., dry rich woods, east of Gertie, *M.L. Fernald et al. 4628* (para-: not localized).

7b. ***Ostrya virginiana*** subsp. ***guatemalensis*** (H.J.P.Winkl.) A.E.Murray

Kalmia 13: 10 (Murray1983). – *O. italica* var. *guatemalensis* H.J.P.Winkl., *Das Pflanzenreich* IV 61 (Heft 19): 22 (Winkler 1904). – *O. guatemalensis* (H.J.P.Winkl.) Rose, *Contributions from the United States National Herbarium* 8 (4): 292 (Rose 1905). – *O. virginiana* var. *guatemalensis* (H.J.P.Winkl.) J.F.MacBr., *Publications of the Field Museum of Natural History, Botanical Series* 4 (7): 193 (MacBride 1929). – Type: Guatemala, Volcán de Fuego, 6400 ft, 7 Aug. 1873, *O. Salvin* s.n. (lecto-, designated here: W1886–8378!; isolecto-: K!). – Additional type material: Guatemala, *J. Donnell Smith* in Donn. Sm. Pl. Guatem. *2470* (syn-: K!); ibid., San Miguel Uspantán, Depart. Quiché, 6000 ft, Apr. 1892, *E.T. Heyde* and *E. Lux* in Donn. Sm. Pl. Guatem. *2910* (syn-: K!, M-0265489!, MO-188762!, WU!); "Guatemala und Costa Rica" (Winkler 1904), *J. von Warszewicz 55* (syn-: not localized). Mexico, Orizaba, Aug. 1853, *F. Müller 1526* (syn-: W0065339!); Mexico, Jalapa, 23 May 1899, *C.G. Pringle 8188* (syn-: BM000993542!, BR0000005269754!, E00870592!, F, GOET!, K!, M-0265488!, MANCH!, P06810561!, P06810571!, P06810594!, PH00020034!, US00898166, UVMVT221269!, W1900–3036!, WU!). – Note: the lectotype was chosen to be the *Salvin* specimen in W because it is the only Guatemalan specimen that bears a note by Winkler. The *Pringle 8188* specimen in W also bears a Winkler note but Rose separated it to his *O. mexicana* Rose. Choosing this specimen as lectotype would make plenty of isolectotypes, but a new name would become necessary in case that the Mexican and the Guatemalan specimens turn out to be different after all.

O. mexicana Rose, *Contributions from the United States National Herbarium* 8 (4): 292 (Rose 1905). – Type: Mexico, Guerrero, Omilteme, 25 May 1903, *E.W. Nelson 7050* (lecto-, designated here: US00089315!; isolecto-: NY00253871!, NY00253872!). – Additional type material: Mexico, Orizaba, *M. Botteri 284* (syn- : GOET!, US00898164); ibid., Jalapa, 23 May 1899, *C.G. Pringle 8188* (syn-: BM000993542!, BR0000005269754!, E00870592!, F, GOET!, K!, M-0265488!, MANCH!, P06810561!, P06810571!, P06810594!, PH00020034!, US00898166, UVMVT221269!, W1900–3036!, WU!).

8. ***Ostrya yunnanensis*** W.K.Hu

Acta Phytotaxonomica Sinica 17 (1): 87 (Li 1979b). – Type: China, Yunnan, Lu-chuan Hsien, in thin forest, 2600 m a.s.l., 5 Dec. 1938, *P.Y. Mao* [*Mao Pin-yi*] *1935* (lecto-, designated here: PE00021988!; isolecto-: KUN446238, KUN446239, PE00734260!, PE00734261!).

Discussion

Our finding that 78 basionyms are missing in major floristic treatments, 46 (plus 3 likely too late to be included) in the *World Checklist* and the bibliography of Fagales (Govaerts & Frodin 1998), and 32 in the WCSP (2016) alone is thought-provoking. Most of the basionyms that have not been treated in the checklists are below species level and none was considered as accepted upon publication. Floristic treatments draw a different picture though, although it must be noted that full synonymy is often not given for stylistic reasons. However, missing four accepted species in the *Flora of China* should be alarming given its importance as a major tool for species identification. Most of the basionyms that have been missed, in general, are likely explained due to the unavailability of the protologues, mainly published in literature from the former Soviet Union, China, and Japan. This is also most likely the explanation for the overlooked species in the *Flora of China*. The fact that *IPNI* did not record infraspecific names before 1971 contributes to the gap. The old-fashioned concept of formalizing minor morphological differences in new taxon names (Endersby 2009) led to a multitude of names that needs to be revised.

Page (2016) coined the term "dark texts" for literature that is not digitally available. However, that term can be expanded to all literature that is unavailable, even if the obstacle is formed by language or the nescience or unavailability of the hard-copy literature. Limited access to material in collections far away from the natural origin, and limited access to, or knowledge of existing literature were – and still are – pitfalls for taxonomy. With new taxa being described constantly, overlooked names are a source of error contributing to the instability of names. This is demonstrated by the fact that the name *Ostrya multinervis* had already been published for a fossil species (Turner 2014) or by the description of a new *Ostryopsis intermedia* B.Tian & J.Q.Liu although a valid basionym, *Corylus davidii* var. *cinerascens* Franch. was already available (Holstein & Weigend 2016). The immense efforts to digitize literature and herbaria during the last years are an enormous help for taxonomic work (Knapp *et al.* 2002; Wheeler 2004, Godfray 2007; Turner 2014), but there is a need for 1) an expansion to publications in non-Latin script, and 2) from a structured review of old literature. The former, then, would profit if the script were not only readable, but also markable for automatic translation. This is of special relevance for texts before 1935 for the question of validity (Art. 39.1, McNeill *et al.* 2012).

Overlooking names due to limited access to literature or nescience is critical not only for the sake of completeness, but because it may lead to overlooking potentially endangered taxa and underestimating biodiversity. Taxon differences are hypotheses that are tested traditionally using morphological characters, and rejection of such hypotheses ends in synonymization of the applied names (Gaston & Mound 1993; Holstein & Luebert 2017). Uncritical adoption of synonymizations might ease taxonomic and floristic work at first, but may well be the source of incorrect subsequent taxonomical decisions. When synonymizations were made, material availability may have been limited or type material may not have been accessible. Critical revision including new data is therefore important (Wheeler 2004). Furthermore, adopting synonymy and ignoring infraspecific taxa appears to be justified, but this is only true if species are regarded as a homogeneous entity. Those who rely on the recognition of heterogeneity within species, such as population geneticists, plant breeders or phytochemists may beg to differ. Overlooking infraspecific taxa should therefore not be belittled (Nixon & Wheeler 1990).

The percentage of non-cultivar synonyms in relation to accepted basionyms is 66.8% in *Carpinus* and 62% in *Ostrya*, both being on the lower spectrum of the numbers found by Scotland & Wortley (2003) for a range of other taxa. However, the number of synonyms between the accepted taxon names greatly differs among the *Carpinus* taxa. While another 14 names represent cultivars of *C. betulus*, many synonymous basionyms belong to wide-spread species. Some of them were likely created due to limited access to material, thus overemphasizing the differences, e.g., in the treatments of Winkler (1904, 1914) and partly of Hu (1929, 1930, 1931, 1932, 1933). Although Iwasaki *et al.* (2010) report only a few instances of hybridization between *C. cordata* and *C. japonica*, and between *C. tschonoskii* and *C. laxiflora*, some of the synonyms, also in *C. turzaninovii*, might be explained by hybridization, or introgression. The five names under *C.* × *schuschaensis* may represent either natural variability or different degrees of introgressive hybridization between *C. betulus* and *C. orientalis*, which had already been suggested in the *Flora of the USSR* (Bobrov 1936). A good number of synonyms, however, was described in regional treatments or even outside a wider taxonomic treatment. An exaggerated focus on local taxa ignoring the species outside of the respective province or country borders carries the risk of overemphasizing local variability and describing more wide-spread taxa repeatedly (Mabberley 1991; Scotland & Wortley 2003; Michelangeli 2005). The aim to produce floras (target 1 of the GSPC), which usually focus on regional to national scales (Funk 2006), might thus create problems, since the whole scope of a species is ignored.

The IUCN Red List (International Union for Conservation of Nature and Natural Resources; status from 29 March 2016) lists 27 species of *Carpinus* with 13 of them classified as "data deficient" and 2, *C. putoensis* and *C. tientaiensis*, as "critically endangered". Shaw *et al.* (2014) also regard *C. hebestroma*

as critically endangered, whereas it is listed as "not assessed" online. For *Ostrya*, the *Red List* gives data for only six species with *O. chisosensis* and *O. rehderiana* listed as critically endangered. As there are at least 42 accepted species plus 17 infraspecific taxa of, partly, poorly known distribution in *Carpinus* alone, the conservation status is clearly very insufficiently documented for this genus. Changing this situation may not be easy, since the acceptance status differs among the current treatments and checklists in 21 of the *Carpinus* names, with four species missing in the *Flora of China*. The stability of taxon status and recognizability of taxa are, however, crucial for conservation, comparison, and monitoring (Mace 2004). The fact that revisionary work is important for conservation has also been shown elsewhere, for example in Juncaceae and Potamogetonaceae (Kirschner & Kaplan 2002) or in *Cotula* (Powell *et al.* 2014). Target 2 of the Global Strategy for Plant Conservation (GSPC) of the Convention of Biological Diversity (CBD, https://www.cbd.int) aims at an assessment of the conservation status of all known plant species. Meeting target 2, however, not only requires an assessment of the taxonomic status as-is, but also critical revisions.

One of the crucial tasks of taxonomic revision, being the localization and identification of type material is tackled here for *Carpinus* and *Ostrya*. This is, however, not always straight-forward, and collections are often wide-spread among different herbaria. The valuable information on where potential type collections are located in *Taxonomic Literature II* (Stafleu & Cowan 1976–1988) help to prioritize herbarium visits, but may leave many collections being ignored for a long time. We found that many types of most (in case of *Ostrya* even all) taxa are already available *in silico*, but many of them have not been marked as type. Completely (or nearly so) digitized collections, such as the ones of the Muséum national d'Histoire naturelle (Paris), Naturalis (L, U, WAG), and the Chinese Virtual Herbarium (PE and partly others) were therefore very convenient. Digitizing type specimens may be a priority and ease taxonomic work quickly (Berents *et al.* 2010), but complete digitization is inevitable. Our finding of the unrecognized type of *C. orientalis* in BM among the specimens in the general collection may serve as a good example, apart from our result that all surveyed herbaria contained hitherto unrecognized type material. Digital collections have been confirmed as a useful low-cost tool (Steudel *et al.* 2012), but they also save time and help preserving specimens thanks to the reduced risks of transportation and handling damage (Friis 2017). However, information on the history of the collectors and collections, usually the expertise from curatorial staff, is a not to be underestimated asset. Premature decisions, such as inappropriate lecto- or neotypifications due to only partly digitized collections may become problematic, just as ongoing taxonomic changes or novelties due to unavailability of (even more modern) literature and physical material. We therefore consider open and easy access to fully-digitized collections to be not only cost-effective in the long-term but also a prerequisite for correct taxonomic work, especially since digital collections are being used more and more.

Conclusion

Despite the great efforts of digitization, we still find yet undiscovered taxon names in *Carpinus* and *Ostrya*, and even recent floristic treatments miss taxa. This is especially critical if publications are hardly accessible and in languages that are not widely understood, which then may explain the limited accessibility in libraries. The loss of names, and therefore hypotheses for taxa, due to oversight of little-known publications, language barriers, and uncritical synonymization, contributes to future taxonomic instability or overlooked biodiversity. Regional treatments ignoring taxa from neighbouring countries might do more harm than good by adding more (superfluous) names. The urgency to inventory biodiversity is without dispute, but it should not go without critical revisionary work. Digital collections turn out to be very valuable for this work, but with many types not recognized as such, partial digitization might give the dangerous illusion of taxonomic work already completed, where it has not even really started.

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