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Article

A new artificial hybrid – *Salix* × *kirchneri* I.V.Belyaeva & O.V.Epanch. (Salicaceae)

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Abstract

A new artificial hybrid, *Salix* × *kirchneri* I.V.Belyaeva & O.E.Epanch., is described. The identities of the parent taxa *Salix glauca* L. f. *cordifolia* (Pursh) I.V.Belyaeva and *Salix nakamurana* Koidz. f. *yezoalpina* (Koidz.) H.Ohashi are discussed and a new combination, *Salix glauca* f. *cordifolia* (Pursh) I.V.Belyaeva, is made. The name, *Salix cyclophylla* Seemen, is lectotypified.

Keywords: new hybrid, Salicaceae, *Salix cordifolia*, *Salix glauca*, *Salix* × *kirchneri*, *Salix nakamurana*, *Salix yezoalpina*

Introduction

Research on arctic-alpine willows in their natural habitats and in cultivation in the Middle Urals has continued since the early 1980s in a project started by Irina V. Belyaeva. The scientific collection of arctic-alpine willows in the Salicetum of the Botanical Garden of the Ural Branch of the Russian Academy of Sciences in Yekaterinburg (BG UB RAS) was founded by her (Belyaeva *et al*., 2003). Since 2003 the scientific curation and observation on arctic-alpine species and hybrids of *Salix* L. in the Salicetum was continued by Olga V. Epanchintseva under the scientific leadership of Lidia A. Semkina.

Currently, 140 accessions of arctic-alpine willows belonging to 61 taxa (42 species and 19 hybrids) are cultivated in the BG UB RAS. One of the main purposes for cultivation of these plants in the Middle Urals is the selection of ornamental, frost- and pest-resistant clones that are fast-growing taken from natural populations and also as a result of artificial hybridisation. Most arctic-alpine willows are slow-growing plants, and it takes patience and some luck to catch fertile female and male plants that are flowering at the same time. Such a fortuitous opportunity came on 30th of May 2019 when two beautiful willows, *Salix glauca* L. f. *cordifolia* (Pursh) I.V.Belyaeva and *S. nakamurana* Koidz. f. *yezoalpina* (Koidz.) H.Ohashi flowered at

the same time at the same place, and artificial pollination by Olga V. Epanchintseva was carried out. Both parent willows had been collected by the authors during their visits to the Botanical Garden of Ruhr University (Bochum), nurseries and private collections in Germany.

Material and methods

For the correct identification of the cultivated plants, specimens of *Salix glauca* and *S. nakamurana* were studied in the herbaria A, BM, CAN, E, G, GH, H, K, LE, MHA, MO, MW, NYBG, **P**, **PH**, PERM, PERTH, S, SAP,* SVER, UPS, VBGI,** WSY (Herbarium Codes are given as in Thiers, 2020; in bold - accessed via *Global Plants JSTOR* (2020); * - photographs of specimens shared by Vladimir Yakubov, ** - seen online at the *Virtual Herbarium of the Botanical Garden-Institute, Far Eastern Branch of RAS*, 2020). The names of the taxa, authors' abbreviations and places of publication follow the nomenclatural database, *International Plant Name Index* (IPNI, 2020). Taxonomy follows Belyaeva & Govaerts (2020). The names of taxa accepted by the authors of this paper are in bold. The names were typified according to the rules of the International Code of Nomenclature of Algae, Fungi, and Plants (ICN; Turland et al., 2018). For distribution, the *World Geographical Scheme for Recording Plant Distribution* (Brummitt, 1992) is used. We adopt here the use of the terms 'male' and 'female,' rather than 'staminate' and 'pistillate,' for flowers, catkins, and plants, as discussed by Dyachenko (2017). All figures mentioned in the text are included in the Appendix.

Artificial pollination involved brushing a male catkin which had fresh pollen of *Salix nakamurana* f. *yezoalpina* onto fully developed stigmas of female catkins of *S. glauca* f. *cordifolia*. During the flowering period of these two willows there were no other *Salix* species in flower, thus eliminating the need for isolation of the catkins.

A ripe catkin with seeds was collected by Irina V. Belyaeva on 6th July 2019 in the BG UB RAS, Yekaterinburg, Russia. Seeds were sown on sterile sand on 11th July 2019 at Willow Mount, Gloucestershire, UK and seedlings were transplanted to individual pots on 15th June 2020 before being planted in open ground on 5th September 2020. Five seedlings (Figs. 1–2) survived the winter and two of them showed faster growth than the other three.

Both parent taxa, *Salix glauca* f. *cordifoli*a and *S. nakamurana* f. *yezoalpina,* are cultivated in the Botanical Garden UB RAS, Yekaterinburg, Russia and in the private willow collection of Irina V. Belyaeva and Keith Chamberlain at Willow Mount, Gloucestershire, UK.

Nomenclature, taxonomy and cultivation

Identity of parent taxa

It is always a problem identifying willows in cultivation as sometimes misidentifications and loss of data of origin occur when moving plants, or labels in the nurseries and garden collections become mismatched. However, even when all the data are correct, taxonomic opinions on the same taxon can be very different and the same clones may be cultivated under different scientific names. The parent taxa of our new hybrid are not an exception, and a discussion of existing opinions and the history of cultivation of these willows are given below to clarify their identity.

The female parent plant, *Salix glauca* f. *cordifolia*, was received from the private collection of Johannes Batke (Braunschweig, Germany) under the accession number SP29, without the exact place of origin (probably Labrador), and was identified by the authors of the current paper as *Salix glauca* L. in 1997. During cultivation of this willow in the Botanical Garden UB RAS, all morphological characteristics were observed and compared to specimens in the herbaria listed above from all around the world. The remarkable characteristics of our cultivated, female parent willow are:

(a) very slow annual growth and prostrate habit (Fig. 3);
(b) leathery leaves with acute apex and with rounded or shallowly cordate base, slightly folded along the central vein, with short petioles (Fig. 4) and half-heart shaped caducous stipules (Fig. 5);
(c) nearly glabrous roundish buds (Figs. 4b & 6);
(d) short female catkins that do not appear every year (Fig. 7).

These characteristics are not often seen together in *Salix glauca*, but one herbarium specimen of *Salix cordifolia* Pursh (now treated as a synonym of *S. glauca* f. *cordifolia*) observed at K in 2015 drew our attention as it looked exactly like our living plant (Fig. 8).

Pursh while describing this willow (1814: 611) listed all of the characteristics of our willow except for the catkins as he had seen it without flowers growing in the garden of G. Anderson (England). The keyword in his description was the name of the willow, 'cordifolia,' which reflects the shape of the leaves. He mentioned also that this willow was introduced into cultivation in the UK from Labrador and resembled, in its general habit, *Salix myrsinites* L. It was listed by Smith (1819: n. 72) and by Forbes (1829: 277, n. 143), who both cited Pursh's description. According to Loudon (1838: 1590) *S. cordifolia* was introduced into Great Britain in 1811. Hooker (1838: 152) wrote about *S. cordifolia*: "The plant thus named for me by Mr Borrer, who is probably acquainted with the original plant cultivated by Mr Anderson, little

deserves the appellation of *cordifolia*, its leaves being more frequently acute than retuse at the base." Several specimens are mounted on the same sheet in Hooker's herbarium at K (Fig. 8), annotated by Borrer, and two of them were mentioned by Hooker (1838: 152) under the name *S. cordifolia*, "Labrador. Kohlmeister. *Dr Morrison.*" and "High parts of the Rocky Mountains. *Drummond*." However, only one specimen corresponds to the original description of *S. cordifolia* from the garden of Mr. Anderson – the specimen that was mounted at the bottom right corner, and only this specimen has some leaves that are slightly cordate at the base. The remaining specimens, all *S. glauca*, were collected by others in different places and do not have any cordate leaves and thus do not belong to our taxon, *S. glauca* f. *cordifolia*. It was the usual practice at that time to mount several specimens on the same herbarium sheet as herbarium paper was costly. Since then, the confusion introduced by Borrer's identification was taken on by different botanists and has continued to the present. Their taxonomic opinions appeared in publications as new infraspecific taxa of *S. cordifolia*, *S. arctica* Pall. and *S. glauca* L. (Belyaeva and Govaerts, 2020).

Salix cordifolia was accepted by Schneider (1918: 343). In his comprehensive analysis he mentioned that Borrer was the only person who had seen the original plant cultivated by Anderson and wrote the name *Salix cordifolia* on Hooker's specimens at K (Fig. 8).

Until the taxonomic revision of the *Salix glauca* complex by Argus (1965), *S. cordifolia* was accepted by Fernald (1950) and Ball (1952). Argus (1965: 64) put *S. cordifolia* into synonymy of *S. glauca*. Of the ten infraspecific taxa of *S. cordifolia* published by different authors (Belyaeva and Govaerts, 2020), only a few of them, mentioned in synonymy below, had the key feature – leaves with a slightly cordate base. *S. cordifolia* was typified by Dorn (2008: 316) who treated it as *S. glauca* var. *cordifolia*. Argus (2010: 92) also accepted this view.

Salix glauca L. f. ***cordifolia*** (Pursh) I.V.Belyaeva, **comb. & stat. nov.** ≡ *Salix cordifolia* Pursh, Fl. Amer. Sept. 2: 611. 1814. ≡ *Salix arctica* Pall. var. *cordifolia* (Pursh) Dippel, Handb. Laubholzk. 2: 311. 1892 ≡ *Salix glauca* L. var. *cordifolia* (Pursh) Dorn, Phytologia 90(3): 316. 2008.

(urn:lsid:ipni.org:names: 77212799-1)

Type: Canada, Newfoundland, Ingornachoix Bay, dry rocky limestone barrens, near sea level, 1.VIII.1910, *Fernald & Wiegand 3219* (GH00255327! – neotype (Fig. 5), designated by Dorn 2008: 316).

= *Salix cordifolia* var. *eucycla* Fern., Rhodora 28: 187. 1926.

Type: Canada, Western Newfoundland, Ingornachoix Bay, dry rocky limestone barrens, near sea level, 4.VIII.1910, *M.L. Fernald & K.M. Wiegand 3204*, ♀, fr. (GH00030943! – holotype).

= *Salix cordifolia* var. *tonsa* Fern., Rhodora 28: 187. 1926.

Type: Canada, Northwestern Newfoundland, Ha-Ha Bay, Ha-Ha Mountain, shelves, crests and talus of diorite cliffs, 5.VIII.1925, *M.L. Fernald & Bayard Long 27971*, ♀, fr. (GH00030942! – holotype; PH00047129! – isotype).

– *Salix cordifolia* var. *typica* Fern., Rhodora 28: 182. 1926, **nom. inval.**

Distribution: Canada: Labrador and Newfoundland.

The male parent plant, *Salix nakamurana* Koidz. var. *yezoalpina* (Koidz.) Kimura, originally from Hokkaido (Japan) was received in 1998 from the private collection of Johannes Batke (Braunschweig, Germany), in 2001 from the collection of the Botanical Garden of Ruhr University (Germany) and in 2009 from the private willow collection of Tapani Uronen (Finland). Similar male clones were also received from the private collection of Siegfried and Danilo Geissler in the Arctic-Alpine Garden (Gorschmitz, Germany) in 2001 and 2011, both under the misapplied name *S. subreniformis* Kimura. Long-term observation of these willows in the Botanical Garden UB RAS showed that all these accessions belong not only to the same taxon, *S. nakamurana* f. *yezoalpina*, but even to the same clone with identical morphology and rhythm of development. This willow was seen by the authors of this paper in the collections of the Meise Botanical Garden (Belgium) and the Arctic-Alpine Garden of the Walter Meusel Foundation (Chemnitz, Germany) growing under the misapplied name *S. kurilensis* Koidz.

Misapplication of the names of taxa in cultivation has already been discussed by Kuzovkina *et al*. (2016a, b) and Belyaeva *et al*. (2018). It is a big problem in nurseries, private collections and gardens when taxonomists are not involved in the identification of cultivated plants. Many mistakes come from a misunderstanding of the nomenclature of willows and additional confusion comes from different taxonomic opinions. A short history of the cultivation of *S. nakamurana* f. *yezoalpina* is presented below.

Krüssmann (1978: 316) described a female plant of *Salix yezoalpina* Koidz from the Hillier Arboretum, UK. Chmelař (1987: 32, 51) described the same willow under two different names, *S. nakamurana* and *S. yezoalpina*, both endemic to the Japanese Islands of Honshu and Hokkaido respectively. *S. nakamurana* was received by Chmelař from the Botanical Garden, Sapporo. *S. yezoalpina* was first introduced into European nurseries as a female clone and then found its place in Chmelař's collection in Brno, Czech Republic. Newsholme (1992: 192) described this willow as very ornamental and referred to both, female and male plants in cultivation as *S. nakamurana* var. *yezoalpina*, pointing out that the male plant was much more

attractive than the female and grew very rapidly. *S. nakamurana* var. *yezoalpina* was mentioned by Lagerström and Uronen (2005: 179) as a highly ornamental willow that was used in artificial infraspecific hybridisation by Tapani Uronen. Brochet (2017: 214) recommended this willow for rockeries, being especially ornamental because of its beautiful male catkins in spring and the bright colour of its leaves in autumn.

After its first introduction into the Middle Urals in 1997/98 (Belyaeva *et al*., 2003), female and male clones of this ornamental willow were cultivated in Botanical Garden UB RAS. The female clone, *S. nakamurana* f. *nakamurana* does not flower every year and neither does it form many catkins (Fig. 9). The male clone, *S. nakamurana* f. *yezoalpina* flowers every year between 9 and 23 May, forming multiple catkins and producing abundant pollen. The female clone is more frost-resistant than the male clone. The latter is often covered with snow while still with leaves (Fig. 10). As reported by Kimura (1928: 574) this willow differs from typical *S. nakamurana* in having orbicular leaves with a cordate base.

The specific characteristics of the cultivated male parent willow, *S. nakamurana* f. *yezoalpina*, are:

(a) rapid growth and prostrate habit with long creeping branches (Fig. 11);

(b) mostly round rugose leaves on long petioles to 4.5 cm, with acute or retuse apex and cuneate, round or cordate base, hairy when young but becoming nearly glabrous when mature (Fig. 12);

(c) multiple male catkins that appear every year with abundant pollen (Fig. 13);

(d) bright yellow leaves in autumn (Fig. 14);

(e) low resistance to frost.

Salix nakamurana Koidz. f. ***yezoalpina*** (Koidz.) H.Ohashi, J. Jap. Bot. 75: 12. 2000 ≡ *S. yezoalpina* Koidz., Bot. Mag. (Tokyo) 30: 332. 1916 ≡ *S. cyclophylla* Seemen, Beibl. Bot. Jahrb. Syst. 67: 41, 1901, nom. illeg. non Gand., 1882, nec Rydberg 1899 ≡ *S. nakamurana* var. *yezoalpina* (Koidz.) Kimura, Bot. Mag. (Tokyo) 42: 574. 1928 ≡ *S. nakamurana* subsp. *yezoalpina* (Koidz.) H.Ohashi, J. Jap. Bot. 75: 12. 2000.

Type: Japan, Jesso, peak of Mt. Rishiri, 25.VII.1899, *U. Faurie 3713* ♀, fr. (KYO00020582! – lectotype, **designated here** by H. Ohashi and I.V. Belyaeva; E00301577! – isolectotype [fragments with fruiting catkins on the left and in a small envelope at the top]).

Note: Koidzumi (1916: 332) published the name *Salix yezoalpina* to replace an illegitimate name, *S. cyclophylla* Seemen, which is a later homonym of *S. cyclophylla* Gand. (Gandoge, 1882: 271). Thus, according to Art. 7.4 of the ICN (Turland *et al*., 2018), the type of *S.*

yezoalpina and of all homotypic synonyms of this name is the type of the replaced synonym *S. cyclophylla* Seemen.

Seemen (1901: 41) cited the herbarium specimen 3713 collected by U. Faurie on 25 July 1899 at "Insel Jesso, Gipfel des Rishiri" in Japan. There are two specimens that belong to the original material: one was located at E (E00301577!) by Irina Belyaeva and the other at KYO (KYO00020582!, Fig. 15) was sent to the authors of this paper by Hiroyoshi Ohashi during the review process and suggested by him as the better choice for the lectotype. These specimens are syntypes as defined in Art. 9.6 of the ICN (Turland *et al*., 2018). Although both specimens were collected on the same date, at the same place, and have the same number, only one, KYO00020582, was annotated by Koidzumi as *Salix yezoalpina* and is represented by several fragments with fruiting catkins. Three fragments are mounted on the herbarium sheet E00301577, two with fruiting catkins (one – on the left and the other in a small envelope at the top of the herbarium sheet, both belonging to *S. yezoalpina* and annotated as such) and the fragment on the left with female catkins which does not belong to *S. yezoalpina* and is marked with a question "Does this belong?" and is possibly a fragment of *Salix udensis* Trautv. & C.A.Mey.

The specimen KYO00020582 is designated here as the lectotype of *S. cyclophylla* Seemen following discussion with Hiroyoshi Ohashi.

Distribution: Russian Far East and Japan.

The new artificial hybrid, *Salix* × *kirchneri*, in cultivation at Willow Mount (Gloucestershire, UK) is represented by five seedlings that show a different combination of the morphological characteristics of both parents.

Salix* × *kirchneri I.V.Belyaeva & O.E.Epanch., **nothosp. nov.**

(urn:lsid:ipni.org:names: 77212800-1)

(*Salix glauca* L. × *S. nakamurana* Koidz.)

Type: United Kingdom, Gloucestershire, Lydbrook, Willow Mount, 14.IX.2020, *I.V. Belyaeva 5-2019*, cultivated since 11.VII.2019 in the private collection of I.V. Belyaeva & K. Chamberlain (holotype – WSY!), Fig. 16.

Description: *Habit*: dwarf shrub. *Branches* woody, creeping (Fig. 17). *Branchlets* greenish brown, sparsely pubescent (Fig. 18). *Buds* dimorphic, ovoid, greyish brown, glabrous or sparsely pubescent. *Generative buds* 3–4 mm long, thick with rounded apex. *Vegetative buds* smaller, 1–2.5 mm long (Figs. 16, 18–19). *Leaves* heteromorphic on one-year-old shoots (Figs. 16, 17, 20), ovate, obovate or sometimes nearly orbiculate, 20–50 mm long, 13–32 mm wide, apex round or short pointed, sometimes folded, slightly twisted, base cuneate, rounded or rarely

cordate, with fine spaced glands, margin ciliate as in most plants of *S. glauca*, slightly revolute, thick, almost leathery, upper surface slightly wrinkled, glabrous, or sparsely pubescent, dark-green, lower surface dull glaucous, more or less pubescent. Young leaves often hairy, later glabrescent and becoming nearly glabrous. *Stipules* minute, rudimentary, caducous (Fig. 18). *Petioles* 2–12 mm long, glabrous or sparsely pubescent. Flowers not seen. *Practical use*: ornamental due to autumn colouring of the leaves (Fig. 21). *Common name*: Kirchner's Willow.

Important diagnostic characters: *Salix* × *kirchneri* differs from *S. glauca* f. *cordifolia* in its faster growth, slightly wrinkled leaves of different form and size, hairy young leaves, minute, rudimentary stipules, longer petioles and colour of the shoots. The hybrid differs from *S. nakamurana* f. *yezoalpina* in having more rounded buds, mostly ovate or obovate leaves and ciliated type of hairiness on the margin of the leaves.

Note: Although the parent taxa of this new artificial hybrid are *Salix glauca* L. f. *cordifolia* (♀) and *S. nakamurana* Koidz. f. *yezoalpina* (♂), the name, *Salix* × *kirchneri*, applies to all hybrids between *S. glauca* and *S. nakamurana*.

Etymology: *Salix* × *kirchneri* named after Bernd Kirchner, former Technical Director of the Botanic Garden of the Ruhr University, Germany who shared cuttings of one of the parent willows and organised visits to the private collection of Johannes Batke (Braunschweig, Germany) where cuttings of the second parent came from.

Distribution: cultivated in the private willow collection of Irina Belyaeva and Keith Chamberlain at Willow Mount, Lydbrook, Gloucestershire, UK.

Cultivation: *Salix* × *kirchneri* is highly ornamental due to its creeping fast-growing shoots and its fresh, green, leathery, rugose and slightly hairy leaves, multicoloured in autumn (Fig. 21). It is easy to propagate by cuttings and by rooting the creeping branches and is recommended for rockeries and alpine gardens. It should be protected from aphids and willow beetles.

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The help of Bernd Kirchner, Johannes Batke, Siegfried and Danilo Geissler (Germany) and Tapani Uronen (Finland) in getting living material of parent willows is greatly appreciated. Irina V. Belyaeva thanks George W. Argus (CAN) for his opinion and friendly scientific discussion on the infraspecific taxa of *Salix glauca* and Vladimir Yakubov for sharing photographs of specimens from SAP. We thank Jennifer Doubt and Chris Deduke (CAN); Antony Brach and Michaela Schmull (GH); Professor Hidetoshi Nagamasu (KYO) for providing digital images of the herbarium specimens. The discussion with Professor Hiroyoshi

Ohashi, on the lectotypification of *Salix cyclophylla* is greatly appreciated. The valuable comments of the other reviewers and editors of the journal helped to improve the manuscript.

Authors' contributions

Irina V. Belyaeva (IB) initiated the project, analysed all available material and resources prepared by OE, grew new hybrid willows from seeds and cultivated them at Willow Mount, UK, prepared herbarium material and photographs, participated in discussions on the preparation of the manuscript, prepared the final version of the manuscript and coordinated the project.

Olga V. Epanchintseva (OE) collected and cultivated the parent willows, carried out the artificial hybridisation, prepared photographs, participated in the preparation of the description of *Salix* × *kirchneri* and discussions of the manuscript.

Lidia A. Semkina (LS) organised the journeys and collected the parent willows with IB and OE and participated in discussions of the manuscript.

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Appendix

Figure 1. Seedlings of *Salix* × *kirchneri* I.V.Belyaeva & O.E.Epanch., 6 October 2019, Willow Mount, UK. Photograph by I.V. Belyaeva.

Figure 2. The two most rapidly growing seedlings of *Salix* × *kirchneri* I.V.Belyaeva & O.E.Epanch. 15 June 2020, Willow Mount, UK. Photographs by I.V. Belyaeva.

Figure 3. *Salix glauca* L. f. *cordifolia* (Pursh) I.V.Belyaeva, Yekaterinburg, Russia, (a, top) 21 June 2012, (b, bottom) 7 May 2017. Photographs by O.V. Epanchintseva.

Figure 4. *Salix glauca* L. f. *cordifolia* (Pursh) I.V.Belyaeva, (a, top) leaves, 21 June 2012, Yekaterinburg, Russia. Photograph by O.V. Epanchintseva. (b, bottom) Leaves and buds, 15 June 2020, Willow Mount, UK. Photograph by I.V. Belyaeva.

Figure 5. Neotype of *Salix cordifolia* Pursh at Gray Herbarium (GH). Permission to reproduce this picture was granted by the Director of Collections of the Herbarium of the Harvard University Herbaria, Michaela Schmull.

Figure 6. Buds of *Salix glauca* L. f. *cordifolia* (Pursh) I.V.Belyaeva, 5 September 2020, Willow Mount, UK. Photograph by I.V. Belyaeva.

Figure 7. *Salix glauca* L. f. *cordifolia* (Pursh) I.V.Belyaeva, Yekaterinburg, Russia, (a, left) with a female catkin, 30 May 2019, (b, right) floriferous shoot, length 45 mm, 31 May 2017. Photographs by O.V. Epanchintseva.

Figure 8. Herbarium specimen of *Salix glauca* L. with *Salix glauca* L. f. *cordifolia* (Pursh) I.V.Belyaeva (bottom right fragment without catkins) at K. Photograph by O.V. Epanchintseva.

Figure 9. *Salix nakamurana* Koidz. f. *nakamurana*. Yekaterinburg, Russia, (a, left) 5 June 2007, (b, right) floriferous shoot, 6 June 2007. Photographs by O.V. Epanchintseva.

Figure 10. *Salix nakamurana* Koidz. f. *yezoalpina* (Koidz.) H.Ohashi, 19 October 2016, Yekaterinburg, Russia. Photograph by O.V. Epanchintseva.

Figure 11. *Salix nakamurana* Koidz. f. *yezoalpina* (Koidz.) H.Ohashi, Yekaterinburg, Russia, (a, top) 2 May 2017, (b, bottom) 11 August 2017. Photographs by O.V. Epanchintseva.

Figure 12. *Salix nakamurana* Koidz. f. *yezoalpina* (Koidz.) H.Ohashi, (a, top left), (b, top right) (c, bottom left) leaves, Willow Mount, UK, 15 June 2020, Photographs by I.V. Belyaeva; (d, bottom right), leaves with long petioles and buds, Yekaterinburg, Russia, 14 September 2016. Photograph by O.V. Epanchintseva.

Figure 13. *Salix nakamurana* Koidz. f. *yezoalpina* (Koidz.) H.Ohashi, Yekaterinburg, Russia, (a, top) male catkins and young hairy leaves, 21 May 2013, (b, bottom) catkins at the start of flowering, 10 May 2017. Photographs by O.V. Epanchintseva.

Figure 14. Bright yellow leaves of *Salix nakamurana* Koidz. f. *yezoalpina* (Koidz.) H.Ohashi in autumn, 21 October 2020, Willow Mount, UK. Photograph by I.V. Belyaeva.

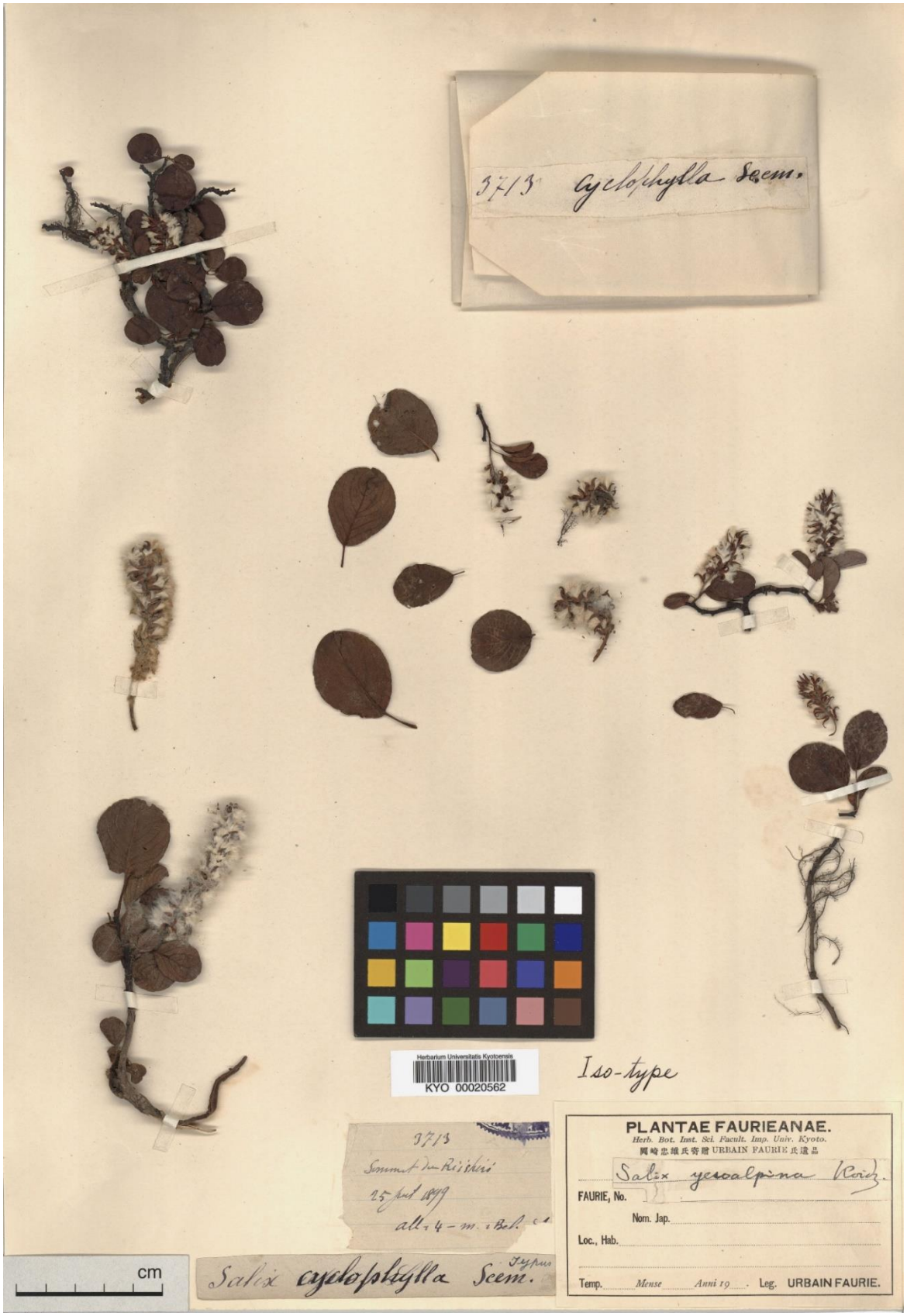

Figure 15. Lectotype of *Salix cyclophylla* Seemen, KYO00020582. Permission to reproduce this picture was granted by the Director of the Kyoto University Museum, Professor Hidetoshi Nagamasu.

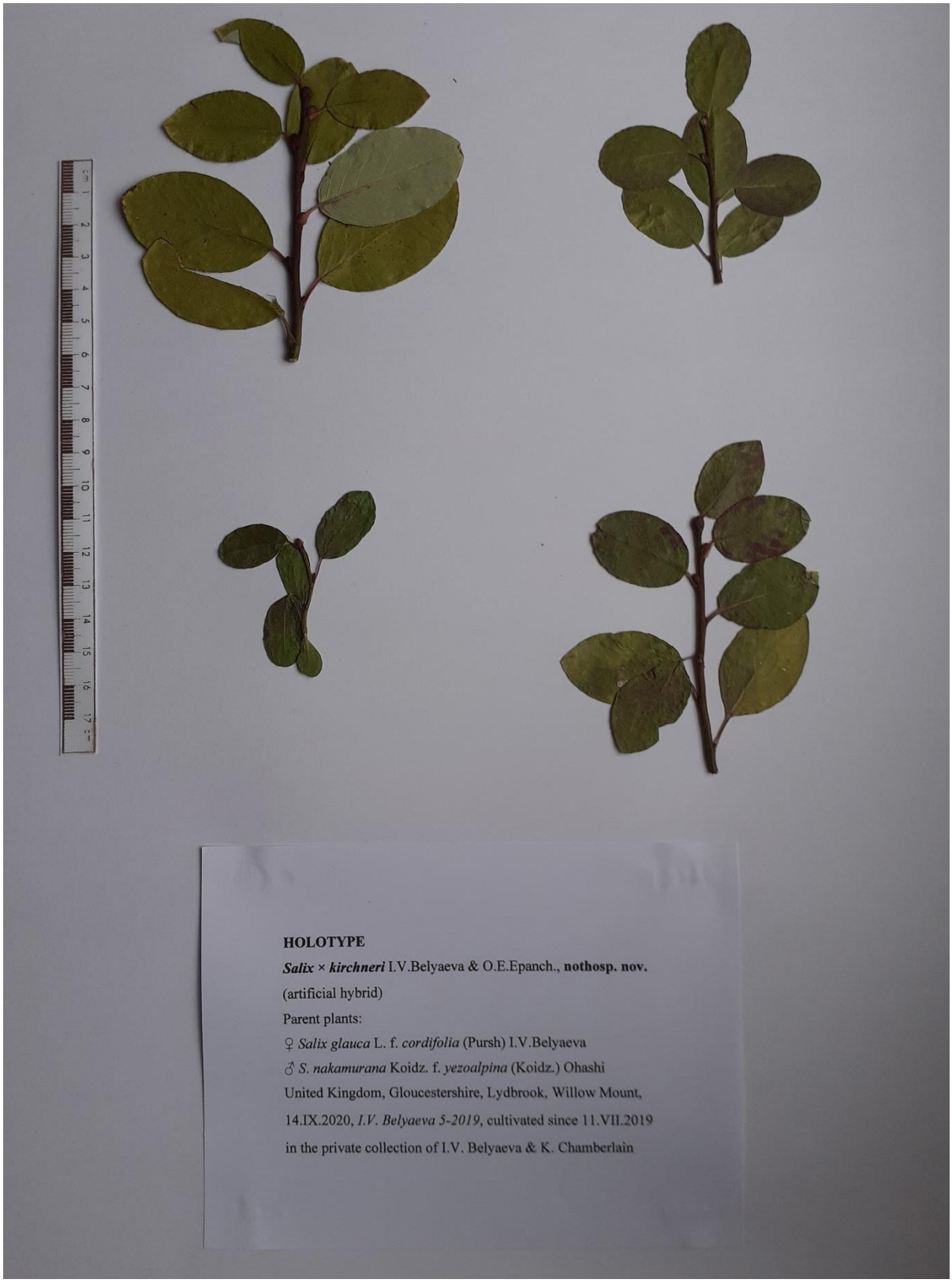

Figure 16. Holotype of *Salix* × *kirchneri* I.V.Belyaeva & O.V.Epanch., the fragments mounted on the sheet are taken from four different seedlings. Photograph by I.V. Belyaeva.

Figure 17. *Salix* × *kirchneri* I.V.Belyaeva & O.V.Epanch., 5 September 2020, Willow Mount, UK. (a, top) From above, (b, bottom) from the side. Photographs by I.V. Belyaeva.

Figure 18. Shoot colours of *Salix* × *kirchneri* I.V.Belyaeva & O.V.Epanch., 5 September 2020, Willow Mount, UK. Photographs by I.V. Belyaeva.

Figure 19. Buds of *Salix* × *kirchneri* I.V.Belyaeva & O.V.Epanch,, Willow Mount, UK. (a, left) 5 September 2020, (b, right) 10 October 2020. Photographs by I.V. Belyaeva.

Figure 20. *Salix* × *kirchneri* I.V.Belyaeva & O.V.Epanch., 5 September 2020, Willow Mount, UK, (a, top left) leaves, (b, top right) showing ciliate leaf margin, (c, bottom) showing hairiness of leaf surface. Photographs by I.V. Belyaeva.

Figure 21. Autumn colours of leaves of *Salix* × *kirchneri* I.V.Belyaeva & O.V.Epanch., 10 October 2020, Willow Mount, UK. Photographs by I.V. Belyaeva.