Notes on the Origin and Pedigree of *Salix* 'The Hague'[1]

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Abstract

Salix 'The Hague' is an ornamental willow, which was selected by the Dutch horticulturist S.G.A. Doorenbos before World War II. It provides early spring floral interest by the way of its large catkins. *Salix* 'The Hague' was first described and listed in many references as a hybrid between *S. caprea* × *S. gracilistyla*. However, a recently analyzed description by Belder noted that it was a hybrid of *S.* × *erdingeri* × *S. gracilistyla*. A study was conducted to review the original herbarium specimens and to verify the pedigree of *S.* 'The Hague' using the ovule number methodology. The analyses asserted that *S.* 'The Hague' was rather a hybrid between *S.* × *erdingeri* and *S. gracilistyla* and should be reclassified in horticultural references. This study also confirmed that there were different genotypes cultivated under the name *S.* 'The Hague'.

Species used in this study: The Hague willow (*Salix* 'The Hague'), Goat willow (*S. caprea* L.), Violet willow (*S. daphnoides* Vill.), *S.* ×*erdingeri,* Rose-gold pussy willow (*S. gracilistyla* Miq.).

Index words: willow, ornamental, floral, ovule, catkin, taxonomy.

Significance to the Horticulture Industry

Clear and accurate records of cultivated plants are important to the horticultural industry. *Salix* is a genus of considerable taxonomic complexity, and accurate identification of its species and hybrids is not always possible. Therefore, there is a lot of confusion with cultivating willows. We analyzed the original references, herbarium specimens and used the number of the ovules in the ovary of the flower to verify the parentage of the popular hybrid cultivar *Salix* 'The Hague'. This study proposes to correct historical inaccuracies related to the origin of this taxon and lists it as a hybrid of *S.* ×*erdingeri* × *S. gracilistyla*.

Introduction

Salix 'The Hague' (syn. *S. hagensis*; *S.* 'Hagensis') is an ornamental willow with an attractive floral display of large catkins. It is a female cultivar selected by the Dutch horticulturist S.G.A. Doorenbos probably before the World War II. Doorenbos was famous for raising many cultivars of *Dahlia*, among other plants, such as *Betula utilis* D.Don 'Doorenbos', *Symphoricarpos* × *doorenbosii* Krüssmann and *Ulmus* 'Den Haag'.

Morphological description. *Salix* 'The Hague' is a vigorous, densely branched shrub or small tree up to 7-10 m (23-33 ft) tall and 3 m (10 ft) wide with thick, spreading stems (Fig. 1, 2). Its bark is gray and is often mottled with darker gray coloration. Large generative buds are located on the upper portion of the stems, with smaller vegetative buds occurring below (type 3, *caprea*-type bud arrangement, according to Skvortsov 1999). Floral buds are brown and pubescent. Leaves are 8–10 cm (3-4 in) long and 2–4 cm (0.8-1.6 in) wide, obovate or oblong, acute or abruptly acuminate, with rounded or truncate base and a serrulate margin. The upper leaf surface is sericeous, dull or glabrescent; the lower surface is grayish white, puberulent. Lateral veins are strictly parallel and prominent, with 14–16 pairs, with appressed white hairs. Stipules are conspicuous 0.5–0.7 cm (0.2-0.3 in) long, and oblique ovate. Petioles are 0.5–1 cm long, puberulent. Flowering is precocious, occurring before leaves emerge during mid to late April, based on the observations in the USDA zones 4-6. Female inflorescences are terete, densely flowered, 4–5 cm long, and 1–1.5 cm in diameter. Peduncles are absent or very short, sometimes with one or two small leaves. Flower bracts are ovate, 3-4 mm long with dense, long hairs, and the upper part is black. Ovaries are ovate sessile with long hairs, stigmas are bifid, and styles are slender and 2.5–3 mm long.

Nomenclature. The first mention of the name 'The Hague' with the synonym *S.* 'Hagensis' was attributed to Bean (1981). Belder (1984) stated that this plant was cultivated as *S.* × *hagensis* in the Netherlands by the Darthuizer Nurseries in Leersum and P.G. Zwijnenburg in Boskoop. Meikle (1989) and Newsholme (1992) listed this plant as *S.* 'Hagensis'. The name "*Salix* × *hagensis* Belder & Door., Dendroflora 21:32 (1984), nom. inval." was listed by the International Plant Names Index (IPNI) (2022). *Salix* 'The Hague' was the accepted name in the "Checklist for Cultivars of *Salix* L. (willow)" (Kuzovkina 2015) and the Royal Horticultural Society Horticultural Database (2022). It was listed as the preferred name in the "List of Names of Woody Plants 2021–2025."

Etymology. The name is likely related to the place where the breeder S.G.A. Doorenbos worked and possibly bred

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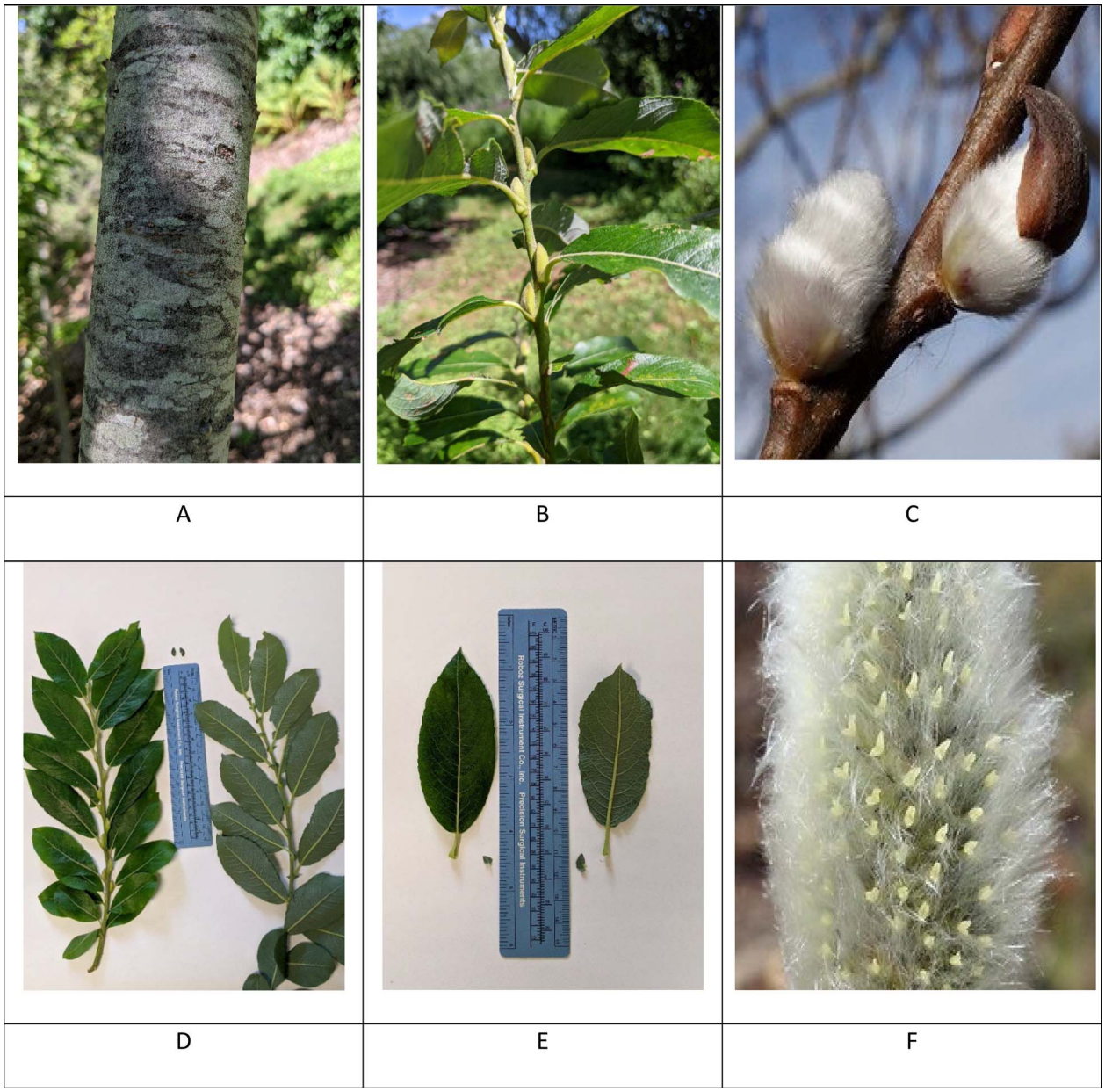

Fig. 1. ***Salix*** **'The Hague': (A) branch bark, (B) branchlet with generative buds, (C) catkins during early stages of expansion with a bud scale, (D) branchlet fragments with upper and lower surfaces, (E) leaves upper and lower surfaces with stipules, (F) catkin during the anthesis. (C and F photos courtesy of Arnold Arboretum, arboretum.harvard.edu.).**

this plant. Doorenbos was the Director of The Hague Parks Department from 1927-1957.

Cultivation. Salix 'The Hague' is a large garden plant, which provides early spring floral interest by way of its large, dense catkins. It is suitable for cultivation in the USDA zone 3A [withstanding winter temperatures as low as -40 C (-40 F)] and prefers wet mesic and mesic soil in the pH range of 5.1-7.8 (National Gardening Association 2022, Daves Garden 2022). Though relatively rare, *S.* 'The Hague' was cultivated in a few public gardens in Europe and North America and was present in trade in the Netherlands and North America (Bean 1981, Walters et al. 1989, Newsholme 1992, PlantScope 2022, Plant Information Online 2021).

Parentage. Salix 'The Hague' was described by Bean (1981) as an alleged hybrid between *S. caprea* L. and *S. gracilistyla* Miq. and later references by Meikle (1989) and Newsholme (1992) repeated the pedigree. A recent verification of the morphological characters of this cultivar, built upon Bean's assumption of its parentage, asserted its affiliation with *S. caprea* × *S. gracilistyla*, as *S.* ×*leucopithecia* Kimura, along with other ornamental cultivars including 'Lubber's Zwart', 'Winter Glory' and 'Rabbit's Foot' (Kuzovkina et al. 2016).

The most recent study, which used the ovule number to verify the parentage of a few hybrids of *Salix,* affirmed that *S.* 'The Hague' was likely belonging to the hybrid combination of *S. caprea* and *S. gracilistyla* (Marchenko and Kuzovkina 2021a). Based upon the hypothesis that the

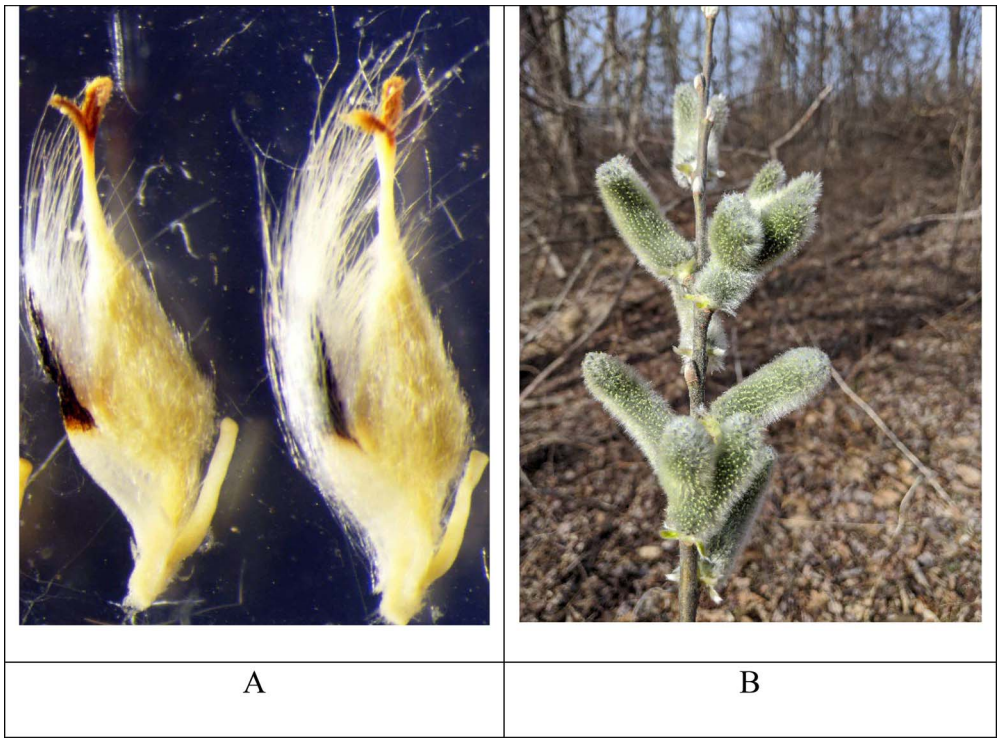

Fig. 2. Pistillate flowers of *Salix* 'The Hague' (a). Branchlet with branched catkins of *Salix* 'The Hague' cultivated at the University of Connecticut, USA (b).

ovule number in a willow hybrid represents the mean of the ovule numbers of its parents (Chmelař 1977; Marchenko 2019; Marchenko and Kuzovkina 2021a b, Marchenko and Kuzovkina 2022), it was estimated that a hybrid of *S. caprea* (ovule index 12–18) and *S. gracilistyla* (ovule index 4–6) should have the *predicted* ovule index of 8–12. A few different specimens of *S.* 'The Hague' procured from various sources including the private collection of C.M. Newsholme, Devon, UK, Westonbirt Arboretum, UK and Bluestem Nursery, Canada, were analyzed to verify their pedigrees. The ovule number recorded from these specimens varied slightly, indicating that these specimens likely represented various genotypes. The ovule index of two specimens (8-11 and 9-12) was within the *predicted* ovule index for such hybrid, while the ovule range of one specimen (6-10) had the minimum number (6) beyond the *predicted* ovule index. The authors concluded that the identity of this specimen requires further elucidation.

A recent analysis of the reference by Belder (1984) shed some light on the origin of 'The Hague', who noted that this plant was a hybrid of *S. gracilistyla* × *S.* × *erdingeri* A.Kern. The Belder citation contains this quote: "During the general meeting of the Dutch Dendrological Society in Nijkerk on March 1, 1980, L.K.J. Ilsink from Zeist, showed the meeting a number of branches of a *Salix* obtained by Doorenbos, a hybrid between *Salix* ×*erdingeri* and *S. gracilistyla*, which were covered with catkins up to the ends of the branches. The Darthuizer Nurseries in Leersum and the company P.G. Zwijnenburg in Boskoop have cultivated this willow, both under the name *Salix* × *hagensis*, a name that is not validly published. In the latest edition of W.J. Bean: "Trees & Shrubs, hardy in the British Isles", this willow has been described as a cultivar. The correct name is now: *Salix* 'The Hague'. According to a statement from the maker, in the first phase *Salix gracilistyla* was used as pollen parent and crossed with *S.* × *erdingeri* as the mother-plant. The work continued with the best seedlings. In 1953, the Wageningen Botanical Gardens received plants of this F2 hybrid under the name *Salix gracilistyla* × *S. erdingeri*. No valid hybrid name is known for such a cross. So, we stick to *Salix* 'The Hague'. During a visit to Boskoop (Proefstation, firm C. Esveld and firm P.G. Zwijnenburg) on September 11, 1973, Doorenbos once again provided the same information about the parents of his willow, as he did in 1953 at the Botanical Gardens in Wageningen. *Salix* 'The Hague' probably was obtained before the World War II.'' The description by Belder (1984), which was written in Dutch language, was probably unnoticed by the authors of some references, such as Meikle (1989) and Newsholme (1992).

Given new information on the parentage of *S.* 'The Hague' as a hybrid of *S.* × *erdingeri* and *S. gracilistyla*, another study was conducted to verify the pedigree of 'The Hague' using the ovule index methodology. An herbarium specimen of *S. erdingeri* × *S. gracilistyla* from the Arboretum of Wageningen University dated by April 17, 1942, was recently analyzed by the authors. It is likely that this specimen represented a hybrid plant made by Doorenbos. It was known that Doorenbos was appointed lecturer of arboriculture at Wageningen University in October of 1939 and was actively involved in planting of the Wageningen Arboretum (Ton Rulkens, The Netherlands, pers. comm., January 2022). Also, the analysis of the ovule number of the herbarium specimen of *S.* 'The Hague' at the

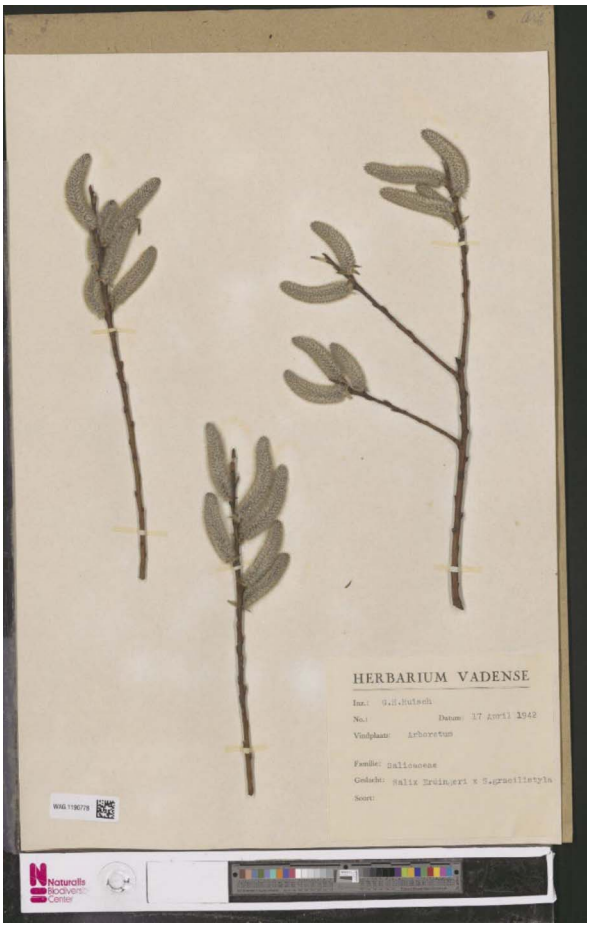

Fig. 3. An herbarium specimen of *S. erdingeri* × *S. gracilistyla* WAG1190778, collected at the Arboretum of Wageningen University on April 17, 1942. Reproduced with kind permission of the Naturalis Biodiversity Center, The Netherlands.

Arnold Arboretum, which was a descendant of the plant received from Kalmthout Arboretum in Belgium in 1971, as well as a live specimen from the University of Connecticut, were added to this study.

Materials and Methods

Plant specimens. The following specimens were analyzed: Specimen #1: herbarium specimen of *S.* × *erdingeri* × *S. gracilistyla* WAG1190778 collected at the Arboretum of Wageningen University on April 17, 1942 (Figure 3). Specimen #2: herbarium specimen of *S.* 'The Hague' cultivated at Arnold Arboretum, accession 999-78D. This plant was derived from the original accession 640-71A (now dead), which was received from Kalmthout Arboretum in Belgium in 1971 (Fig. 4). It is likely that this clone was disseminated from the Arnold Arboretum to some U.S. nurseries. Specimen #3: live specimen grown at the University of Connecticut, which was procured from Bluestem Nursery, Canada. The ovule indexes for the presumed parents of *S.* 'The Hague' – *S. caprea* (12-18), *S. daphnoides* (6-6), *S. gracilistyla* (4-6) – were used to calculate the *predicted* ovule indexes for the hybrids. Their values were obtained from previous studies (Chmelař 1977, Marchenko 2019; Marchenko and Kuzovkina 2021).

Ovule count. The ovule counts were performed according to the experimental protocols by Marchenko (2019) and Marchenko & Kuzovkina (2021 a, b). For each specimen, the fractions of ovaries with a different number of ovules and the ovule index, recorded as the minimum-maximum range of ovules per ovary in a catkin (for example, n=10-12) were documented. The counts were made for all well-developed ovaries (without abnormalities) in the catkin,

Fig. 4. Herbarium specimens of *S.* 'The Hague' (accessions 999-78 and 999-78D), collected at the Arnold Arboretum of Harvard University in 1984 and 2010.

Table 1. The ovule data for the three specimens of S. 'The Hague', *S. caprea*, *S. daphnoides*, *S. gracilistyla* and the *predicted* ovule index for *S. ×erdingeri* (*S. caprea* × *S. daphnoides*), *S. ×erdingeri* × *S. gracilistyla* and *S. caprea* × *S. gracilistyla*.[z]

Specimens	No. of ovules per ovary															Ovule
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	index
Percentage of ovaries in the catkin																
Specimen #1 WAG1190778 Arboretum of Wageningen University				23	42	21	14									**7-10**
Specimen #2 Arnold Arboretum of Harvard University (accession 999-78).				15	30	41	14									**7-10**
Specimen #3 University of Connecticut/ Bluestem Nursery, Canada						35	56	9								**9-11**
S. caprea									49	13	9	7	13	6	3	12-18
S. daphnoides			100													6-6
S. gracilistyla	7	8	85													4-6
S. ×erdingeri (*S. caprea* × *S. daphnoides*)																9-12
S. ×erdingeri × *S. gracilistyla* =																6-9
S. caprea × *S. gracilistyla*)																8-12

[z]The shaded cells represent the occurrence of ovaries with a specific number of ovules in the catkin. The number in the cells represents the percentages of the ovaries with a specific number of ovules in a catkin. Analogous shading (either yellow or blue) shows similar ovule indexes of the specimens of *S.* 'The Hague'. Shaded cells without numbers represent the occurrence of ovaries with a specific number of ovules for hybrids based on the *predicted* ovule index.

using reflected and transmitted light microscopy. Morphological characteristics of the plants were documented to confirm their identifications.

The *predicted* ovule index for *S.* × *erdingeri* – a hybrid between *S. caprea* (ovule index 12–18) and *S. daphnoides* (ovule index 6–6) was 9–12, calculated as the following: the mean of the minimum ovule index of the parents: 12 + 6 =18 /2 =9, the mean of the maximum ovule index of the parents: 18 + 6 = 24 /2=12. The *predicted* ovule index for a hybrid between *S. ×erdingeri* (ovule index 9–12) and *S. gracilistyla* (ovule index 4–6) was 6-9, while the *predicted* ovule index for a hybrid between *S. caprea* (ovule index 12–18) and *S. gracilistyla* (ovule index 4–6) was 8–12.

Results and Discussion

The results of the ovule count of the three specimens of *S.* 'The Hague' are presented in Table 1. The numbers of ovules per ovary in Specimens 1, 2 and 3 were intermediate between the presumed parent species *S. caprea, S. daphnoides,* and *S. gracilistyla,* as apparent from their central position in the Table 1. The ovule indexes for Specimens 1 and 2 (7-10) were identical and were rather aligned with the *predicted* ovule index for *S.* × *erdingeri* × *S. gracilistyla*. Specimens 1 and 2 had slightly different distributions of the ovules and could represent different genotypes. It is possible that Doorenbos selected and distributed a few offspring from the same cross. This fact

was confirmed by Belder (1984) who mentioned that the "work continued with the best seedlings".

The higher ovule index for Specimen 3 (9-11) was more aligned with the *predicted* ovule index for *S.* × *erdingeri* (*S. caprea* × *S. daphnoides*). The study also confirmed the previous suggestion that there were different clones in cultivation under the name *S.* 'The Hague' with various ovule indexes (Marchenko and Kuzovkina 2021a). Interestingly, Specimen #3 occasionally produced branched catkins, the growth of which was observed in the collection during some years. Various aberrations of catkins were previously recorded in some hybrid willow's cultivars. For example, large catkins with lumps were described for a male cultivar *S.* 'Rabbit's Foot' from a similar hybrid combination *S. caprea* × *S. gracilistyla* (Kuzovkina et al. 2016).

In conclusion, the analysis of the description by Belder (1984), along with the study of the ovule number from the original herbarium specimens from the Arboretum of Wageningen University and Arnold Arboretum, asserted that *S.* 'The Hague' was rather a hybrid between *S.* × *erdingeri* × *S. gracilistyla*. *Salix* 'The Hague', which was previously listed as a cultivar of *S. caprea* × *S. gracilistyla* by Bean (1981), Meikle (1989), Newsholme (1992) and in the *Checklist for cultivars of Salix L. (willow)* (Kuzovkina 2015) should be reclassified as a hybrid of *S.* × *erdingeri* × *S. gracilistyla*. This study also confirmed that there were different genotypes cultivated under the name *S.* 'The Hague'.

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