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Willows growing naturally and subspontaneously in Meise Botanic Garden

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Abstract

Willows growing naturally and subspontaneously in the historic domain of Meise Botanic Garden (MBG) in the vicinity of Brussels have been surveyed, and their local frequency has been compared to their known distribution in Flanders (northern Belgium). Fourteen *Salix* taxa were found, among which were several rare or very rare hybrids, such as *Salix* × *capreola* A.Kern. ex Andersson, *S.* ×*charrieri* Chass. and *S.* × *subsericea* Döll. The latter hybrid must have originated from a cultivated *S. repens*. An as yet unidentified willow has been encountered, which is likely a hybrid of a non-native *Salix* in the outdoor collections. The richest willow flora occurs around the lakes and in the semi-natural moist woody areas. Some willows, such as *S. viminalis* once grown for basketry near the castle, are descendants of previously existing plantings. It is clear that willows play a significant ecological, economic and cultural-historical role in the MBG domain.

Keywords: *Salix*, escapes, hybrids, Meise Botanic Garden, rare taxa, subspontaneous taxa

Introduction

Situated 15 km north of Brussels, Meise Botanic Garden (MBG) is a research institution and tourist attraction with large and diverse botanical collections. It is located in a 91-hectare domain, made up of parts of two historic castle estates (Ronse and Vidts, 2011). This domain partly consists of semi-natural vegetation and extensively managed forested areas, some of them containing valuable wetlands of petrifying springs with tufa formation – small hard-water springs characterised by active formation of calcium carbonate porous rock, their vegetation dominated by bryophytes (European Habitat type H7220, Ronse, 2011a). There are also several lakes and rivers or streams favourable for rich natural willow vegetation. On the other hand, the domain also hosts an outdoor collection of willows. It is well known that cultivated plants can escape

from collections, sometimes spreading outside botanic gardens (Hulme, 2015). In MBG more than 150 escapees from the outdoor collections were found by Ronse (2011b). Willows can also be expected to escape from the collections, mainly by producing seedlings in the vicinity. Cultivated willows may also form hybrids with spontaneous willows. These possibilities prompted us to study the willows growing within the MBG domain.

The development of the Integrated Management Plan for the domain has also required inventories of the biodiversity within each zone, including willows. Such a plan is necessary to balance and integrate the diverse functions of the domain: recreational, scientific, economical, ecological and conservation function, including conservation of biodiversity as well as that of historical and cultural heritage. In fact, the pressure on the land has been rapidly increasing as new infrastructure, including collections, buildings and activities, has been intensively developing.

Therefore, a survey of the willows occurring naturally and subspontaneously in the MBG domain was initiated in 2011. The results have not been previously published or analysed because of taxonomic problems with *Salix fragilis* L. This situation had actually been resolved several years ago by Belyaeva (2009) and more recently clarified specifically for Belgium by Zwaenepoel (2019). For this study, earlier data were critically reassessed using herbarium material whenever possible and complemented with more recent data.

Materials and Methods

Plant inventories in the MBG were undertaken by the sector. Sectors are small zones separated from one another by roads or paths; altogether, there are more than 50 sectors. Plant lists for each sector were compiled from 2002 to 2011, and the results were published by Ronse (2011c). The second round of inventories was undertaken in all sectors in 2012–2017. Additional inventories regarding specifically *Salix* taxa were produced in May 2019. Names of taxa and author abbreviations are given in accordance with *International Plant Name Index* (IPNI, 2020).

Herbarium specimens of several *Salix* taxa were collected between 2002 and 2019, especially of hybrids and taxa whose identity was not known. The specimens were identified using the most recent literature on *Salix* taxonomy, according to Zwaenepoel (2019), based on Belyaeva (2009), except for *S. cinerea* subsp. o*leifolia* Macreight, which is regarded as a separate species, *Salix atrocinerea* Brot., by most salicologists of the world (Rechinger, 1964, 1981; Rechinger and Akeroyd, 1993; Skvortsov, 1968, 1999; Jalas and Suominen, 1976; Neumann, 1981; Lautenschlager-Fleury and Lautenschlager, 1994; Newsholm, 1992; Blanco, 1993;

Hörandl *et al.*, 2002; Fischer *et al*., 2005, Zinovjev and Kadis, 2009; Argus *et al*., 2010; Uotila, 2011; Dickman and Kuzovkina, 2014; Belyaeva and Govaerts, 2020) . Additionally, *S.* × *guinieri* Chass. has been included under the name *S. guinieri* Chass. & Goerz, also in accordance with the *World Checklist of Vascular Plants* (WCVP, 2020). The willows were determined to the specific level, without using nothovarieties or forms.

Additionally, some observations of willows in the MBG domain were retrieved from https://www.waarnemingen.be., a database of Belgian biodiversity observations, as well as the global database *Global Biodiversity Information Facility* (GBIF, 2019).

The frequency of each *Salix* taxon found in MBG was expressed as the number of sectors in which it occurred. This local frequency was compared with the respective assessment of the taxon's occurrence within Flanders, northern Belgium, as designated in the *Flemish Plant Atlas* (Zwaenepoel, 2006). Whenever no assessment was provided of the taxon's occurrence in the *Plant Atlas*, we referred to the Belgian database (2019) https://www.waarnemingen.be.

Results and Discussion

To date, 14 natural and subspontaneous *Salix* species and hybrids have been found in MBG (Table 1). Their local frequency rather closely follows the occurrence at the all-Flemish level, where *Salix alba* L. and *S. caprea* L. are the two most widespread species. The latter species is by far the most frequent one, probably because it also grows in less humid woody areas. Among *S. alba* we found one tree belonging to *S. alba* subsp. *caerulea* (Sm.) Rech.f.

The frequency in the MBG domain is not congruent with that at the all-Flemish level for *Salix viminalis* L.: it is common in Flanders but has been found in only one location in the domain. As a matter of fact, this species is probably not really native in Belgium but has been introduced and cultivated for a long time because of its use in basketry (Zwaenepoel, 2006). The fact that this species has been found at the Castle Lake as just a male plant could confirm the hypothesis that it had been planted there in earlier times. Indeed, Zwaenepoel states that male clones were used until the 19th century, but have been replaced by female clones since then. The *S. viminalis* in the domain might thus well be an historical cultivation relict dating back to at least the 19th century.

Another *Salix* tree which is obviously a historical relict known as *Salix babylonica* L. var. *pekinensis* A.Henry f. *tortuosa* Y.L.Chou (accepted name, according to Belyaeva *et al*., 2018 and POWO, 2020, is *Salix* × *pendulina* Wender. f. *erythroflexuosa* I.V.Belyaeva), was found near the

historical building at the entrance to the domain (not included in Table 1, as it is not natural or subspontaneous). It must have been planted there before the relocation of the Botanic Garden from Brussels to Meise, thus before 1930.

Table 1. *Salix* taxa occurring, either naturally or subspontaneously, in the MBG domain; their local frequency (as number of sectors) and occurrence assessment within Flanders, according to Zwaenepoel (2006), or to https://www.waarnemingen.be (indicated with *)

Taxon	Local frequency	Occurrence in Flanders
Salix caprea L.	19	extremely common
Salix alba L.	9	extremely common
Salix × *fragilis* L.	7	very common
Salix cinerea L.	6	very common
Salix × *reichardtii* A.Kern.	6	very common
Salix aurita L.	5	common
Salix × *multinervis* Döll	3	common
Salix atrocinerea Brot.	2	rare*
Salix × *capreola* A.Kern ex Andersson	1	very rare
Salix × *charrieri* Chass.	1	very rare
Salix guinieri Chass. & Goerz	1	rather common*
Salix × *subsericea* Döll	1	rare*
Salix viminalis L.	1	common
Salix sp.	1	--

According to the results in Table 1, several rare or very rare *Salix* taxa occur in Meise, such as *S. atrocinerea* Brot. and its hybrid with *S. aurita* L., S. × *charrieri* Chass. Another very rare taxon is S. × *capreola* A.Kern. ex Andersson, a hybrid between *S. aurita* and *S. caprea*. These hybrids of *S. aurita* as well as the species itself are considered by the authors rather remarkable finds. *S. aurita* is indicative of poor, mostly sandy soils. It has been declining in northern Belgium because of the general soil eutrophication (Zwaenepoel, 2006). Though naturally fertile loamy soil occurs in MBG, no fertilisers have ever been applied in the natural habitats, which might explain the occurrence of *S. aurita* and its hybrids. In addition to these hybrids, we have also found *S. guinieri*, a species that is often regarded a hybrid between *S. atrocinerea* and *S. cinerea* and that is rather common in northern Belgium. The sectors where all these willows occur are located near the Castle Lake and Orangery Lake, within the so-called Wild Meise, the least disturbed area containing valuable moist forests, as well as at the pond in the courtyard of the main building. These areas are the most willow-rich areas of the MBG domain. The courtyard is of anthropogenic origin and may seem a somewhat odd location. It is,

however, a nearly undisturbed area where plants with wind-dispersed seeds can establish themselves.

Among our findings, there is another rare willow, which we would not expect in Meise, namely *Salix* × *subsericea*, a hybrid between *S. cinerea* and *S. repens* L. As *S. repens* is nearly always confined to sandy areas, such as dunes or the Campine (heathland and pine forest area), we would not have expected to find it during our survey. This could raise the question about the origin of the *S.* × *subsericea* in MBG. However, *S. repens* is cultivated in the outdoor collections, and thus the cultivated *S. repens* and the naturally growing *S. cinerea* must have been the parents of the spontaneously formed hybrid.

Finally, a willow has been encountered which has not been identified so far; it is mentioned as *Salix* sp. in Table 1. It may well be a hybrid between a cultivated non-native species and a native species, but this must be investigated further. It is clearly not a native taxon.

Conclusions

Willows play a significant ecological, economic and cultural-historical role in the MBG domain. In the moist areas a rich willow flora was found containing nearly all naturally occurring taxa in the region. The *Salix* hotspots are situated around the Castle Lake and Orangery Lake, at the edge of the swamp forests with tufa formation, and in an undisturbed area at the pond between the wings of the main Garden building. Therefore, willows are locally important from an ecological point of view, as they are native trees present as main structural elements in the valuable damp and humid zones; moreover, their pollen and nectar provide a food source for many insects, including some wild bees for which they are the sole food source. As a significant pollen source for honeybees in early spring, willows are also valuable for MBG economically: they contribute to the locally produced honey sold in the Garden shop. Willows may be considered cultural-historical relicts, as some were probably planted here more than a century ago for basketry production.

On the other hand, the spontaneous willow flora is influenced by the nearby *Salix* collections. Until now, no escaped willows have proved to belong to any of the native species, but as the collections contain 10 native taxa, some of the escapees may have been well established in the semi-natural areas without anyone noticing. That could only be demonstrated with genetic analyses. It appears that several willows have formed hybrids outside the collections. This is not surprising, as hybridisation, backcrossing and introgression often occur within the genus *Salix*, as indicated by Zwaenepoel (2019). We have found two examples of this: one is *S.* × *subsericea*,

most probably a spontaneous hybrid of the native *S. cinerea* with cultivated *S. repens*; the other is a yet unidentified willow, supposedly a hybrid of a non-native willow. Our data demonstrate that willows from the outdoor collections influence the naturally and subspontaneously growing willows in the MBG domain and surroundings.

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