

## NOTA BREU

## Rare ornamental trees in the process of naturalization in the lower Ter River (Catalonia, Iberian Peninsula)

### Arbres ornamentals rars en procés de naturalització al baix riu Ter (Catalunya, península Ibèrica)

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The role of trees planted for ornamental and forestry uses as a source of introduction of alien flora is well known (e.g. Richardson & Rejmánek, 2011; Brundu *et al.*, 2016; Čeplová *et al.*, 2017). The plain of the Ter river near the town of Girona (lowland of north-east Catalonia) combines two factors that makes it a particularly good area for the naturalization of alien trees, since in the floodplain there are extensive plantations of timber trees (*Populus × canadensis*, *Platanus × hispanica*) and some important nurseries of ornamental trees have also been established on the alluvial terraces. This is the case of the municipalities of Celrà and Bordils, on the right bank of this river, where several tree species escaped from the nurseries are known, including four particularly rare ones that are being discussed in this note and that are considered to be in process of local naturalization, more advanced for *Morus australis*. These trees have been found mainly in plane tree or poplar plantations, in the undergrowth of which many alien plant species thrive, such as *Bidens subalternans*, *Oenothera oelkersii*, *Oxalis latifolia*, *Phytolacca americana*, *Solanum elaeagnifolium*, *Solidago altissima*, *Symphyotrichum pilosum* or *Vitis riparia*. It is a semi-artificial and temporarily unstable habitat, but the long cycles of timber exploitation (especially in the case of plane tree) can favour the naturalization in its

understory of introduced trees and their expansion towards the neighbouring riparian forests, which are already very disturbed and show a strong occurrence of non-native species. It has been noted that three of these species are currently known as cultivated in neighbouring nurseries; the exception is *Celtis sinensis*, but it is likely that it has also been cultivated there, as it is known from nurseries in relatively close areas. For each species, synthetic information is provided on its location (UTM 31T zone square 1 × 1 km ETRS84), habitat and estimated current population.

#### *Celtis occidentalis* L.

Gironès: Celrà, Els Arenys, DG9054, 9055, 40 m, old *Platanus* plantation, c. 50 young individuals, 20-IX-2022 (Fig. 1a); Celrà, next to the sewage treatment plant, DG8954, 45 m, field margin, c. 10 individuals (1 possibly planted), 30-IX-2022; Celrà, L'Illa, DG8954, 45 m, *Populus* and *Platanus* plantations, 1 mature and c. 20 young individuals, 30-IX-2022.

This species native to North America (Barker, 1997) is fairly common as alien, even invasive, in cool temperate regions of Europe (e.g. Bartha & Czišár, 2008; Breunig, 2010;



Figures 1. Leaves of : a) *Celtis occidentalis* and b) *Celtis sinensis*, Celrà.

## NOTA BREU

Celesti-Grapow *et al.*, 2010; Pyšek *et al.*, 2012); however it is very rarely observed in the Mediterranean region (Jiménez *et al.*, 2010; Olivieri, 2017). In Catalonia it has only been reported as casual in a suburban riparian forest of Segre river in the town of Lleida (J. Pedrol *in* Sáez & Aymerich, 2021). In the Ter floodplain it has been found in three places separated by a maximum distance of 1.5 km, and about 80 individuals have been observed. It is the only one of the four species here discussed for which it has been possible to verify the presence of at least one apparently unplanted reproductive individual, although the vast majority are juveniles of 0.4-1.5 m high. In the same areas where *C. occidentalis* occurs, the Mediterranean species *C. australis* is common -from which it can be distinguished because the latter has narrower, caudate and more toothed leaves- and in one of the places *C. sinensis* has also been observed (see below).

*Celtis sinensis* Pers.

Gironès: Celrà, Els Arenys, DG9054, 9055, 40 m, old *Platanus* plantation, c. 50 young individuals, 20-IX-2022 (Fig. 1b).

A species native to China and Japan (Fu *et al.*, 2003) that is known as naturalized and locally invasive in eastern Australia (Batianoff & Butler, 2002; Hosking *et al.*, 2003), in North America (Whittemore, 2008) and in South Africa (Siebert *et al.*, 2018), where it mainly occurs in riparian and suburban habitats. Apparently, it had not been reported as alien in Europe until very recently, when Gesti (2022) published the discovery of a few young individuals in Anglès, about 23 km south-west of the Celrà location, and in a similar habitat (riparian forest close to a garden nursery). These two records close in space and time suggest that *C. sinensis* is starting a naturalization process in north-eastern Catalonia, where the subhumid Mediterranean climate is potentially favourable for this species. An assessment of the invasive potential of *C. sinensis* in Spain showed a medium-low risk (Andreu, 2011). This species can be distinguished from *C. australis* and *C. occidentalis* by the absence of teeth on the lower half of the leaves, a reliable character even for juvenile plants (Siebert *et al.*, 2018).

*Morus australis* Poir.

Gironès: Bordils, Celrà and Cervià de Ter, right bank of the river Ter floodplain, between El Sorralet and L'Illa areas, DG8954, 8955, 9054, 9055, 9155, 9255, 9256, 35-45 m, mainly in *Platanus* and *Populus* plantations, hundreds of juvenile individuals, 20/30-IX-2022 (Figs 2a,b).

In recent times, garden plant nurseries have generalized the commercialization of mulberry trees with deeply lobed leaves, which are often grown in Mediterranean urban areas and are generally known as «*Morus kagayamae*» or «*Morus alba* Kagayamae», although its relationship with the true *Morus kagayamae* Koidz. is uncertain. This taxon is native to a small Japan area and is generally accepted that it falls within the variability of *M. australis* Poir., a species widely distributed throughout the south and east of Asia (Zhu & Gilbert, 2003). Laguna & Ferrer (2014) analyzed the «Kagayamae» mulberry trees grown in València area (Eastern Iberian Peninsula) and reached the conclusion that under this gardening name could be sold true *M. kagayamae*, other forms of *M. australis* and also *M. alba* with lobed leaves. Morphologically, *M. kagayamae* would be slightly different from typical *M. australis*, but there are no consensus on its diagnostic characters in different works that treated the question (Katsumata, 1974; Iwatsuki *et al.*, 2006). The taxonomy of this *Morus* group is complex, but recent works do not recognize *M. kagayamae* (e.g. Gardner *et al.*, 2020) and there are even proposals to merge *M. australis* into *M. alba* (Zeng *et al.*, 2015) based on phylogenetic data. The nomenclature of *M. australis* has also been the subject of some controversy: we



Figures 2. *Morus australis*, Bordils: a) young trees with lobed and entire leaves; b) detail of a leaf showing the scabrous upper surface.

use the name *M. australis* in the sense of works as Zhu & Gilbert (2003), Gardner *et al.* (2020) or Nepal & Purintum (2021), but the name *M. indica* L. is often also applied to these same plants (e.g. POWO, 2022).

In the poplar and plane tree plantations of the river Ter plain, many young mulberry trees with generally lobed but also entire leaves have been observed, which clearly do not belong to the *M. alba* traditionally naturalized in the Mediterranean riparian forests. These mulberries are characterized by having dark green leaves, dull and scabrous in the upper surface, characters absent in *M. alba*, which typically has leaves with upper side glabrous, shiny, smooth and often light green. On the contrary, these leaf characters do fit well the *M. australis* descriptions of Wu *et al.* (2003) or Iwatsuki *et al.* (2006), especially the scabrous upper side. The scabrous leaves would also be characteristic of the mulberries referred to *M. kagayamae* by Katsumata (1974), while it would be smooth and shiny according to Iwatsuki *et al.* (2006).

In the Ter plain we have observed hundreds of young *M. australis* scattered over an area of about 6 hectares, mainly in *Populus* and *Platanus* plantations, but also some in riparian forests and field margins. Individuals range in size from less than 0.5 to more than 4 m, and it is likely that some are close to reach the reproductive capacity. Its local abundance and the extent of occurrence make it plausible a short-term naturalization in this area. A single published occurrence of *M. australis* in Catalonia is known: a young individual found in Montjuïc, within the urban area of Barcelona (Gómez-Bellver *et al.*, 2019, sub *M. kagayamae*), and there are also observations of young trees born spontaneously in large gardens of another area of Barcelona, Horta is known (L. Gustamante, pers. comm.). *Morus australis* (sub *M. indica* or *M. kagayamae*) has also been reported as casual in Italy, usually in urban environments (Ardenghi & Polani, 2016; Galasso *et al.*, 2018), although some observations in suburban riparian habitats in Rome (Olivieri *et al.*, 2016) suggest an incipient naturalization process.

#### *Pyrus calleryana* Decne.

Gironès: Celrà, Els Arenys, DG9054, 9055, 40 m, old *Platanus* plantation, c. 40 young individuals, 20-IX-2022 (Fig. 3).

This eastern Asian species (China, Japan, Vietnam) is used as an ornamental tree in other world areas. In the Iberian Peninsula its use has increased in recent decades, mainly as street tree, and generally the «Chanticleer» variety is planted. *Pyrus calleryana* is an important invasive species in the United States, where the first observations in natural habitats are from the 1960s and naturalization has involved «Bradford» and related cultivars (Culley & Hardiman, 2007; Sapkota *et al.*, 2022). It has also been reported as naturalized in south-eastern Australia (Brodie & Reynolds, 2012). In contrast, we are not aware of any published data on this tree as alien in Europe, where the probability of naturalization was assessed as high a few years ago, according to an analysis of European ornamental flora not yet naturalized (Haeuser, 2017). The small population find in Celrà therefore represents a first record of *P. calleryana* naturalization in Europe. Here less than 50 young trees were ob-



Figure 3. *Pyrus calleryana* leaves, Celrà.

served, concentrated in a small area of 0.2 hectares and with sizes from less than 0.5 to more than 3 m, of which the larger individuals are likely to produce fruit soon. The future success of this incipient naturalization is uncertain, because generally the cultivar «Chanticleer» produces few fruits and this factor would limit its ability to spread.

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## NOTA BREU

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