

Communication

Assessment of a threatened species *Ulmus minor* in north-western Tunisia

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Abstract

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The status of *Ulmus minor* Mill., a threatened species in Tunisia, was assessed. The study aimed to determine the habitat conditions and gather ecological information about the species and its habitats in north-western Tunisia since the lack of data on the abundance and distribution of this species is a significant obstacle to its proper conservation. The results revealed that the species is currently distributed in Tunisia in two localities (Oued El Kebir in Tabarka and Tbeinia in Ain Draham). The populations occur in deep, very wet, loamy or clay loam soils of low acidity. The main threats to the species are overexploitation by local people and disease caused by the ascomycete *Ophiostoma novo-ulmi*. Conservation of *Ulmus minor* can only be achieved through habitat maintenance and sustainable use of natural resources.

Keywords: conservation, distribution, Dutch elm disease, habitat conditions.

INTRODUCTION

Biodiversity assessment is a global scientific priority to maintain sustainable development and use of ecosystems. More research is needed to develop and maintain a science-based understanding of nature and its management, enabling us to understand and assess all ecosystem components better (Cotterill, 1995). Accurate identification of species is essential for understanding the basic biological and ecological traits of a plant and its geographical distribution (Lavergne et al., 2005). However, there is still a lack of information on some plant species' biological and ecological characteristics (Pyšek et al., 2008). Plants of the genus *Ulmus* L. are valuable forest trees. They

are also used to form protective belts and hedgerows. Reboul & Taris (1967) have stated that they are often grown along roadsides to create shelterbelts. The timber of *Ulmus* trees is widely used for firewood and furniture production (Reboul & Taris, 1967; Venturas et al., 2013; Perdignero et al., 2015).

In his study, Heybroek (2015) has noted that *Ulmus minor* Mill. is strongly associated with human activities. It provides forestry, agricultural and cultural services. *Ulmus minor* has traditionally been used in viticulture as fodder for livestock, ornamental purposes, and various other uses. In the 20th century, a disease caused by the ascomycete *Ophiostoma novo-ulmi* Brasier (elm graphiosis) led to the extinction of many adult *Ulmus minor* trees in many regions of

Europe, North America and North Africa (Pinon & Cadic, 2007). In Europe, this species is mainly found in forests and along their edges (Collin, 2001; Piou et al., 2018). In Tunisia, *Ulmus minor* occurs at the southwestern limit of its range and usually grows along the edges of wadis and water sources (Ghrabi-Gammar et al., 2009; Eduard et al., 2010). The distribution of *Ulmus minor* in Tunisia is overly complex. The results of the 1995 and 2005 forest inventories in Tunisia did not include this species. For this reason, we selected the sampling stations using data from the forest inventory as well as data from previous studies by Cosson (1885) and Debazac (1959) and data from Ghrabi-Gammar et al. (2009) and Eduard et al. (2010). Individuals of *Ulmus minor* can live for almost 400 years and reach a height of up to 35 m.

None of the Tunisian researchers have studied the habitat conditions of this species. At the national level, even forest inventories have not been able to confirm its existence. Therefore, this study aimed to determine the current distribution and habitat conditions of the endangered *Ulmus minor* in Tunisia.

MATERIALS AND METHODS

As *Ulmus minor* was not included in the Tunisian forest inventory, we identified the sampling sites subjectively, using information from previous studies by Cosson (1883) and Debazac (1959). A total of eight sites were selected for the study of habitat conditions (Table 1). *Ulmus minor* was only recorded at two new sites in the study area during this research (2021–2022): on the banks of the Oued El Kebir in Tabarka and at Tbeinia in Ain Draham. *Ulmus minor* has not been found in any other previously reported localities. To characterise the distribution of this spe-

cies, the GPS coordinates of each *Ulmus minor* tree with a diameter of at least 5 cm were recorded. Detailed information on historical and current localities of *Ulmus minor* is given in Table 1.

The topographical characteristics of *Ulmus minor* habitats were described, indicating altitude (in m above sea level), slope (in %) and orientation (Jdaidi & Hasnaoui, 2018). The edaphic conditions of the habitats were described by referring to the study of Gunot & Schoenenberger (1967) on the phytocological map of northern Tunisia. Meteorological data were obtained from the Tabarka and Ain Draham meteorological stations. We considered annual precipitation (mm), mean annual temperature (°C), and minimum and maximum temperatures (°C).

RESULTS AND DISCUSSION

In Tunisia, *Ulmus minor* has been previously recorded in the regions of Ain Draham (Ain Saida plain, Oued Delma, Ain Jemel, Oued Zen), Tabarka (Oued El Kebir, Oued Titria) and Fernana (Fedj El Saha) (Cosson, 1885; Debazac, 1959). This species was found during this study in Oued El Kebir (Tabarka) and Tbeinia (Fig. 1).

Ulmus minor has not been found in any other previously reported localities. The species is thought to have died out because of a disease caused by the ascomycete *Ophiostoma novo-ulmi* (graphiosis). Caudullo & De Rigo (2016) and Piou et al. (2018) have claimed that the disease affected all old elms in the late 1970s.

In addition, *Ulmus minor* is a fodder species used to feed domestic animals. It is recognised (You, 2011) as a remarkable fodder plant that provides large biomass with good nutritional quality. The leaves of this

Table 1. List of the studied *Ulmus minor* localities and their characteristics. Historical localities are marked with an asterisk (*)

Code	Locality	Geographical coordinates	Altitude (m a. s. l.)	Slope (%)	Slope orientation
S1	Oued El Kebir	36.5210 °N; 08.4633 °E	120	5	North-west
S2	Oued Titria*	36.5556 °N; 08.5647 °E	175	10	North-east
S3	Ain Saida*	36.5225 °N; 08.4147 °E	227	5	North-west
S4	Ain Jmel*	36.5220 °N; 08.4144 °E	255	15	North-east
S5	Oued Delma*	36.5110 °N; 08.4736 °E	360	10	North-east
S6	Fedj El Saha*	36.4723 °N; 08.4742 °E	405	5	North-west
S7	Oued Zen*	36.4715 °N; 08.4815 °E	615	5	North-west
S8	Tbeinia	36.4613 °N; 08.4636 °E	750	10	North-west

plant are extremely rich in nutrients, twice as much as clover and lucerne. In addition, the wood of this species is hard, moisture resistant and exceedingly popular in the woodworking industry. Excessive felling, combined with repeated fires in north-western Tunisia caused by overgrazing, may have contributed to the extinction of most of the previously recorded populations. Furthermore, Tom (2021) has shown that threats to elm forests worldwide come from human activities, fungal invasions and climate change.

In the Ain Draham area, *Ulmus minor* usually forms small groups (Fig. 2). Occasionally, solitary trees occur on the banks of wadis and rivers. It also occurs in narrow valleys at the foot of mountains, in communities with other woodland species

such as *Tamarix gallica* L., *Prunus avium* (L.) L., *Quercus canariensis* Willd., *Olea europea* L., *Populus nigra* L., *Populus alba* L., *Alnus glutinosa* (L.) Gaertn., *Laurus nobilis* L., *Quercus suber* L., *Nerium oleander* L., *Myrtus communis* L., *Arbutus unedo* L., sometimes with *Fraxinus australis* Mont. ex Gren. & Godr., *Salix pedicellata* Desf., *Smilax aspera* L., *Vitis vinifera* L., *Viburnum tinus* L. and even more rarely with *Rhamnus alternus* L., *Pistacia lentiscus* L.

In the northwest of Tunisia, populations of *Ulmus minor* occur in a region with a mean annual precipitation ranging from 1030 mm to 1550 mm. This area is characterised by an average annual temperature of between 9°C and 15.5°C, with a maximum temperature ranging from 19°C to 26°C. The species grows best at low and medium altitudes (120–750 m above sea level). *Ulmus minor* prefers light and grows best on north-western and north-eastern slopes.

As a result, the north-western and north-eastern slopes in the study area receive more water than the south-eastern and southern slopes, which may affect the natural distribution of *Ulmus minor* and the whole ecosystem. This species usually grows on silty or silty-clay soils. *Ulmus minor* avoids heavy clay soils with low porosity and acid sandy soils. It usually grows on soils rich in organic matter.

Ulmus minor is a more thermophilous species than other species of the genus *Ulmus* and has a more southerly distribution in the main part of its range. It has a wide tolerance of ecological conditions and can grow in dry, newly formed habitats and alluvial forests (Caudullo & De Rigo, 2016; Fragnière et al., 2022).

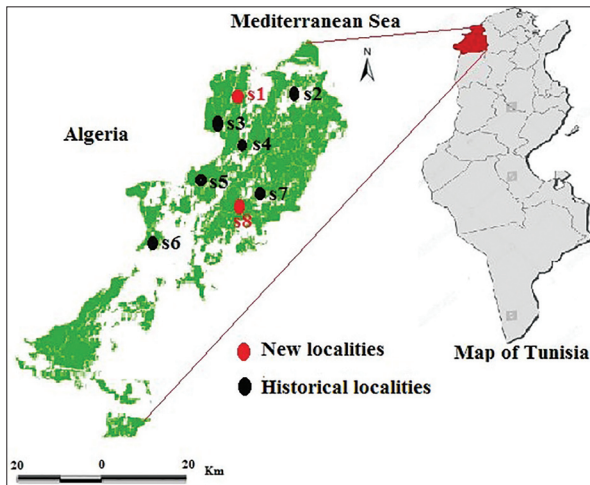


Fig. 1. Localities of historical and newly recorded populations of *Ulmus minor* in Tunisia.



Fig. 2. The site of *Ulmus minor* at Oued El Kebir in Tabarka (A) and the habitat at Tbeinia in Ain Draham (B). Photographs by J. Nouri.

The results of the distribution assessment and the evaluation of the extant populations of this threatened species in Tunisia will facilitate further research and help to improve its conservation. Current knowledge about the habitat conditions of *Ulmus minor* makes it possible to precisely define the limits of its current and potential distribution in Tunisia. *Ulmus minor* must be conserved both in its natural habitats and in forest nurseries, as this in-depth knowledge of the environmental requirements is necessary to ensure the survival of the species. Therefore, two conservation strategies, *ex situ* and *in situ*, should be implemented.

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