Inventory of historical local mulberry trees

Documenting the Locations and Morphological Diversity of Local Mulberry Varieties in Sericultural Landscapes of European Countries

DEVELOPED UNDER THE RECREATION OF EUROPEAN MULBERRY HERITAGE

Introductory notes

The inventory of historical mulberry trees (*Morus alba* and *Morus nigra*) in the ARACNE project countries builds on their deep historical, economic, and cultural significance. For centuries, mulberries have been central to sericulture across Europe, Asia, and beyond, supporting silk production while preserving a valuable genetic resource.
To document old local mulberry trees in the sericulture regions of the participating partners, Morus APP was developed. This application has been instrumental in creating a comprehensive database cataloguing the tree locations, basic information, and morphological descriptors of historical mulberry trees, supporting comparisons between morphology-based grouping and genetic classification.

Open Morus APP

Building on this database, a Mulberry Story Map was developed, that helps people discover and visit these trees, while raising national awareness and support for their protection. In parallel, ARACNE is exploring new ways to reintroduce mulberries into modern agroecosystems, reviving distinctive landscapes and highlighting mulberries as multifunctional trees that strengthen biodiversity and provide essential ecosystem services, from habitat support to climate resilience. By safeguarding outstanding monumental trees, the project contributes directly to the long-term protection and valorisation of Europe's mulberry genetic resources.

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Historical Roots of White Mulberry

The European history of the cultivation of white mulberry (*M. alba*), is a complex narrative spanning hundreds of years. Native to China it was introduced to Europe between the ninth and twelfth centuries in order to spread sericulture and silk trade, although precise records of the introduction are elusive. Before *M. alba* became widespread, black mulberry (*M. nigra*), originating from the Near East, was the dominant species in Europe. Literary and archaeological evidence suggests that *M. nigra* was cultivated in Europe and the Mediterranean region since ancient times for its fruit and medicinal properties.

The spread of white mulberry throughout Europe followed trade routes, royal decrees, and agricultural innovation, with notable attempts to expand mulberry cultivation in regions outside Aracne countries like Austria, Germany, Czech Republic, Poland and United Kingdom.

White mulberry trees can be found throughout Europe, especially in the southern silk-producing countries, where they have been an integral part of the landscape for centuries and bear witness to the former activity of silk production. In European countries, a number of centuries-old mulberry varieties have survived, representing an outstanding natural heritage that reflects past socio-economic and political history. The old varieties are also a valuable genetic resource that is best adapted to specific climatic conditions and can make an important contribution to sustainable mulberry cultivation to meet the increasing demand of the silk industry.

Morphological characteristics of the white mulberry tree (ID SI23_00199), including tree habitus, lobed and simple leaves (adaxial and abaxial views), infructescence and trunk aspect.

Italy

In Italy, white mulberry (*Morus alba*) was introduced together with the development of sericulture. Authors have suggested an earlier introduction in Sicily during the reign of King Ruggero II, likely reflecting the importance of silk production in Sicily at that time; however, this claim is not supported by independent historical evidence. The first documented introduction of *M. alba* in Italy is generally placed in the early 15th century. Before then, the mulberry species most widely known in Europe through the Middle Ages was the black mulberry (*M. nigra*). Italy's silk industry flourished from the 13th century onwards, with major cultivation areas emerging in Veneto, Emilia-Romagna, and Sicily. By the 14th and 15th centuries, mulberry

cultivation had become economically important, as indicated by a tax on mulberry leaves in Bologna and historical reports of mulberry imports to Tuscany.
Even at the end of the 15th century, mulberry growing appears to have been scarcely practised in Lombardy, Liguria, and Piedmont, while it was already well established in Veneto and Emilia-Romagna, in inland Tuscany, Marche and Umbria, Sicily, Calabria, and the area between Naples and Salerno. In the late Renaissance, mulberry cultivation was concentrated in hilly and foothill areas, occurred only sporadically in the lower plains, and was almost entirely absent from coastal or excessively humid zones.
During the 17th century, the spread of mulberry trees and silkworm rearing continued, becoming closely linked to mixed farming systems and sharecropping arrangements. At the same time, exports of raw silk to major trading centres and manufacturing hubs in northern Europe increased. Mulberries, however, remained mainly concentrated in hilly and foothill areas. In the 18th century, their expansion accelerated, with increasingly dense cultivation even on damp plains and large estates. From this period onwards, mulberries were increasingly planted in rows together with vines in the tradition of La "Pientata Veneta".
The second half of the 18th century, and especially the 19th century, marked the peak expansion of mulberry cultivation. It spread even into less suitable areas such as irrigated zones (e.g., the Polesine) and increased on dry lowland farms. This expansion was accompanied by gradual changes in management. Trees were pruned more intensively to limit growth and facilitate leaf harvesting during periods of rapid silkworm development, and new varieties were introduced that were more productive or considered better suited than traditional varieties.

Spain

Sericulture in Spain began under Arab rule, with early use of *M. nigra* in regions like Las Alpujarras, Granada. In the 16th century, *M. alba* was introduced in Valencia and Murcia for its superior silk production. Mulberry cultivation expanded in the fertile "Huerta" regions, with mulberry trees lining field boundaries and irrigation canals. Nobles and the Church controlled large plantations, distributing leaves to tenant farmers. Native varieties such as 'Valenciana' and 'Cristiana' became central to Spain’s silk production until its gradual decline.

France

In France white mulberry appeared in the late 14th century, spreading in Languedoc and Corsica. Under King Henry IV’s initiative in the 16th century, Olivier de Serres promoted large-scale cultivation of *M. alba* to boost

domestic silk production. Regions such as Gard, Ardèche, and Drôme became major producers, with mulberry trees planted along plot boundaries for silkworm rearing. Despite the decline of silk production in the 20th century, historic "Sully" mulberries remain symbols of France's sericultural legacy.

Slovenia

Sericulture in Slovenia began in the 16th century, introduced to the Gorizia region from Friuli-Venezia. By the 17th century, mulberries spread across Primorska region, supported by noble families such as the Dukes of Eggenberg. In the 18th century, Carniola implemented measures to promote mulberry planting, with nurseries supplying seedlings across Dolenjska and Styria regions. Large plantations were established on estates such as Novo Celje, known as "Styrian Eden," for their superior cultivation practices of horticultural trees and vineyards in the tradition of La "Pientata Veneta". However, wars, agricultural crises, and low silk prices led to a decline by the late 19th century. Sericulture briefly revived post-WWII but ended by the 1960s, surviving longest in the Vipava Valley.

Bulgaria

Sericulture in Bulgaria dates back to the first Bulgarian Empire (10th century AD), with large-scale planting of mulberry trees in the 19th century. Historically, *M. alba* and *M. nigra* were planted as tall, single-stem trees along roads in villages and towns. By 1930, twelve Italian mulberry varieties were imported, and local genotypes such as 'Vratsa 1' and 'Trakia 6' were developed. By 1990, approximately 1.6 million mulberry trees were documented, though this number has since declined.

Greece

Mulberry cultivation in Greece dates to ancient times, with *M. nigra* mentioned by Theophrastus around 350 BC. Sericulture began in 553 AD, when monks introduced silkworms during the Byzantine Empire. Until the early 14th century, texts referenced mulberries without clear distinction between *M. nigra* and *M. alb*a. In the 18th century, structured sericulture emerged, especially on Chios. Greek farmers adopted grafting techniques, introducing varieties from Italy and Japan. By the 20th century, ornamental mulberries became common, although traditional sericulture persists in some regions, blending modern and ancient practices.

Georgia

Black mulberry has thrived in Georgia since the Tertiary period, while *M. alba* was likely introduced in ancient times. Sericulture began in the 5th century under King Vakhtang Gorgasali. Georgia developed diverse local mulberry varieties, such as 'Imereti 90' and 'Tbilisuri,' known for their leaf nutrition and

fruit quality. In 1963, dwarf leaf disease devastated mulberry plantations, but resistant varieties restored production by the 1970s. Today, about four million mulberry trees are grown, primarily near farmers' yards. These trees, many highly productive, remain integral to Georgia's sericulture and natural heritage.

Each ARACNE partner country has a rich history of mulberry cultivation tied to sericulture. The history of mulberry cultivation in the Aracne countries has been described in detail in Deliverable D1.4_ "Report on the collected mulberry samples" (2024) and D1.7_"Report on silk narrative catalogue Version 1" (2024).

Monumental white mulberry trees

In Italy, 111 locations with monumental mulberry trees (trunk circumference >300 cm) were recorded. The largest and most remarkable specimens occur in the private plantation of Mauro Rizzotti in Vivaro (Province of Pordenone), often described as a "Noah's Ark" of mulberry genetic heritage, where more than 700 trees aged 70–400 years are preserved (Benedetti & Fila, 2023). The outstanding trees include "The God's Hand" (IT23_00443, 880 cm), "The King" (IT23_00442, 700 cm) and the "Napoleon Tree" (IT23_00439, 560 cm). A further monumental tree of 880 cm was recorded in the mulberry plantation in Thiene (IT23_00444). Notable urban specimens include IT24_01056 from Sossano (600 cm) and IT24_01057 from Verona (590 cm), while IT23_00725, located in the garden of the Corte Bottegal company in Lonigo and planted before 1735, measures 570 cm.
In Slovenia, 60 trees with trunk circumferences > 300 cm were recorded using MorusAPP. The largest known tree (previously presented in Deliverable D1.4) is located at the Fabiani homestead in Kobdilj (SI23_00356) with a circumference of 752 cm. In 2024, a 500 cm tree was recorded near the Church of St. Kancian in Truške (SI24_01048), accompanied by a white mulberry measuring 325 cm (SI24_01047). Another outstanding specimen is a 480 cm tree in a private garden in Bočaji (SI24_01049). A historically important site is SI23_00234 from Miren (447 cm), forming part of a traditional row of 45 mulberry trees used for sericulture.
In Bulgaria, 66 monumental trees with trunk circumferences >300 cm were recorded. In 2024, 26 trees were documented, including two exceeding 500 cm and eight between 400 and 500 cm, and in 2025 a further 20 monumental trees were added. The largest specimen is BG23_00672 from Plovdiv (630 cm), followed by BG24_01078 from Veliki Preslav (570 cm) and BG23_00641 from Sevlievo (530 cm).
In France, impressive mulberry trees were recorded in an old plantation in Saint-Martin-de-Lansuscle (FR23_00601, FR25_01485), visited by the ARACNE University of Maribor team in August 2025. Within the village, several additional trees with trunk circumferences exceeding 300 cm were also documented. Two old white mulberry trees were recorded in front of the Sericine rearing house and at the entrance to the plantation in Gravas and Bagard (FR25_01476, FR25_01478).
In Greece, mulberry cultivation and sericulture remain closely linked to regions such as Thessaly, Macedonia, and the

Peloponnese. In Soufli, most recorded trees measured 150–250 cm, while the widest documented tree reached 331 cm (GR23_00031).

In Spain, monumental white mulberries were recorded mainly in Murcia. In 2025, seven trees with circumferences >300 cm were documented, including ES25_01470 from La Albatalia (>500 cm) and two additional trees exceeding 400 cm (ES25_01351, ES25_01374). In 2024, 25 trees >300 cm were recorded, with the largest reaching 496 cm (ES24_00926) and another large tree in Murcia measuring 452 cm (ES24_00963), although both were in very poor condition.

In Georgia, eight trees with circumferences >300 cm were recorded, including two trees >500 cm (GE24_00911, GE24_00954) and three around 400 cm (GE24_00958, GE24_00976, GE25_01579). Several outstanding trees were documented in Tbilisi, including GE24_00958 in a park near the Silk Museum. The row of mulberry trees in front of the Silk Museum (GE25_01581–GE25_01583) continues directly from a row of Maclura pomifera trees.

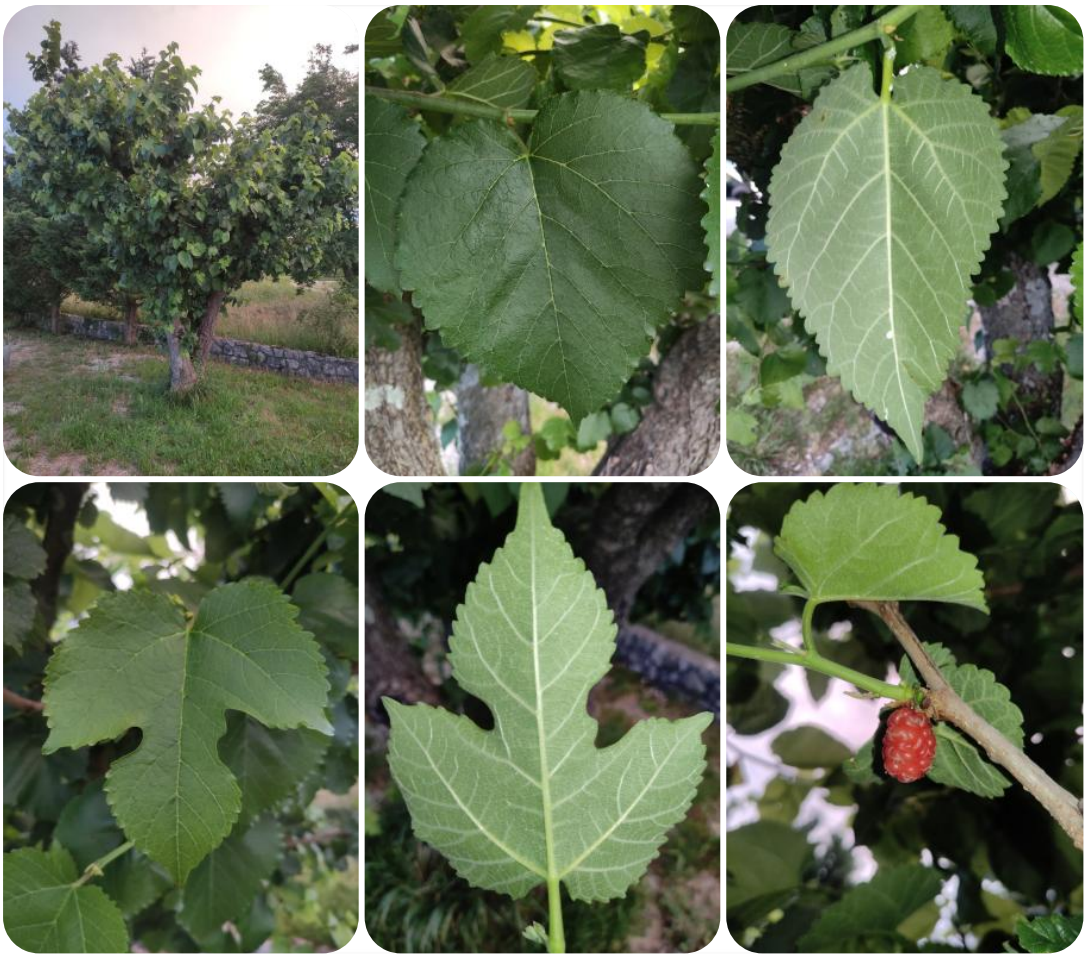
Inventory of monumental white mulberry trees (*Morus alba*). Locations are listed by tree ID number.

Historical Roots of Black Mulberry

Morus nigra originated in the Near East. It was known by the Greeks and Romans before the Christian era. It was also cultivated in ancient Egypt (Ahlawat et al. 2016). However, the

exact origin of *M. nigra* is still unknown. Both literary and archaeo-botanical records indicate that *M. nigra* thrived in the Near East and in Europe, at least since the Iron Age and Roman times. This is much earlier than *M. alba*, which is native to China and was introduced into this area (together with silkworms) in late Byzantine times or even later. For historians, there is still a controversy regarding the origin and time of the first introduction of mulberry in Italy. Most historians agree that *M. nigra* came to Italy from Persia. The black mulberry was introduced to Europe and Britain more than 500 years ago and cultivated as food for silkworms. Although this venture did not prove successful, its fruit is still eaten in various forms today. It is cultivated for its fruits in southern Europe and southwest Asia and is the most important mulberry species in the Mediterranean countries. *M. nigra* was rapidly adopted and cultivated for its fruits in the Mediterranean world and also for its pharmaceutical and cosmetic properties. In antiquity, Pliny the Elder (77 AD) described the mulberry tree as 'sapientissima arborum', the wisest of trees (Naturalis Historia, book XVI, cap LXI, v 102). According to his findings its berries were frequently eaten and used by Greeks and Romans as ingredients for a delicious, sweet wine, called 'moretum'. In European medieval times black mulberries were still popular for making drinks, such as fruit juice, cider or wine, and for sweetening dishes as a sauce or syrup. In the mid-eighteenth century, Carl Linneaus believed that *M. nigra* was indigenous to Southern Italy and had certainly been cultivated there for over 2000 years. In France and Spain, Archebotanist Marie-Pierre Ruas and her colleagues have presented evidence that the Romans introduced *M. nigra* as a fruit tree to southern France in 1st century BC and it began to be cultivated in Languedoc in the fourth century AD again for its fruit. The black mulberry also came to Britannia (Southern England), as preserved fruit (or seed) with the Romans in the second century AD.

The black mulberry (Turkish name ‘Kara Dut’) is widely grown in Turkey. Along with Mediterranean conditions, Northeast part of Turkey, in particular the Coruh valley has notable populations of black mulberry, which have been cultivated in gardens for their delicious edible fruits.



Morphological characteristics of the black mulberry tree (*Morus nigra*) (ID SI23_00153), including tree habitus, simple and lobed leaves (adaxial and abaxial views), and infructescence.

Monumental black mulberry trees

The black mulberry trees with the largest circumferences were recorded in Spain, with most individuals exceeding 300 cm in circumference. The largest tree, ES24_01002, with a circumference of 725 cm, is located in Andaluz, Soria. Other magnificent trees with circumferences exceeding 600 cm were recorded in Torrepadre (ES24_00992) and Villoviado (ES24_00995), both situated in the province of Burgos. Another tree with a circumference greater than 600 cm was found in Roussa, Greece (GR23_00774).

In Bulgaria, two black mulberry trees were recorded. One well-known specimen, located in Vratsa, grows directly from a house wall and has a trunk circumference of 170 cm (BG23_00657). The second tree, BG25_01519 from Gorski Izvor, has a trunk circumference of 233 cm.

In France two old trees are located in Mercoire, Cevennes, whereas one young tree was planted in front of the Maison Rouge museum. Georgia reported two notable trees in Zeda Orghuli (GE24_00845) and Tbilisi (GE24_00891).

In Slovenia, remarkable trees were found in a private olive orchard in Škocjan near Koper (SI24_01033, SI24_01034), as well as in Žusterna (SI24_01035) and Osp (SI23_00197). Unfortunately, the tree located on the street to Korte (SI23_00190), which was sampled in 2023, has been cut down. Numerous magnificent trees were also found on the island of Cres, Croatia.

Inventory of monumental black mulberry trees (*Morus nigra*). Locations are listed by tree ID number.

Identifying mulberry trees

In European countries, a number of centuries-old mulberry trees have survived as living witnesses of historical sericulture, representing an outstanding natural heritage shaped by past socio-economic priorities and trade routes.

White mulberry (*Morus alba*) is by far the most common species. Introduced from Asia, it was widely planted to feed silkworms and became an integral feature of European landscapes—especially in former sericultural regions, where it was often planted along streets, field margins, and farmyards. In contrast, black mulberry (*M. nigra*) originates from the Near East and has been present in Europe since antiquity. Today, it persists mainly as scattered, often venerable trees of high cultural and natural heritage value.

Identifying mulberries in the field can be deceptively difficult. Despite the names “white” and “black” mulberry, fruit colour is not a reliable diagnostic trait as white mulberry varieties can produce infructescences ranging from yellowish-white and light pink to purple-brown, reddish-black, and black. Mulberries also show substantial variability in leaf form, being simple and/or lobed, driven by genotype, environmental conditions, tree age, and pruning practices. Long cultivation, generative propagation in the past, and later grafting practices and propagation by cuttings have further diversified the European mulberry gene pool.

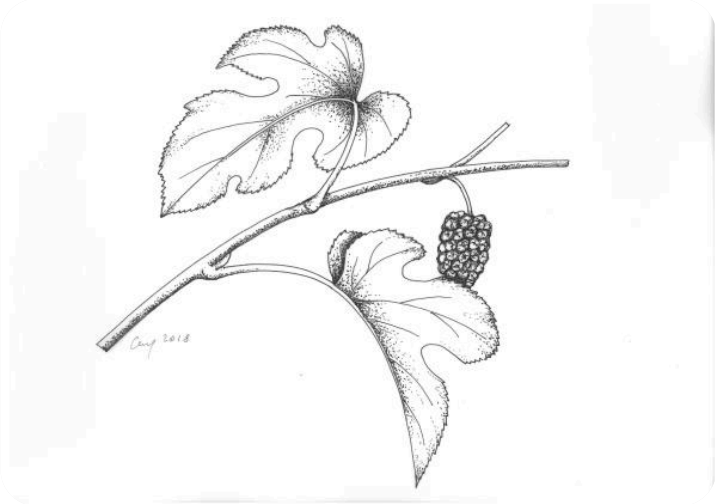
This chapter provides practical guidance for distinguishing white and black mulberry trees. The following sections focus on dendrological (tree-level) and morphological (organ-level) characteristics that most consistently separate *M. alba* from *M. nigra.*

White mulberry

White mulberry (*Morus alba*) originates from China, where it has been cultivated for more than 4,500 years. It is a deciduous tree that can reach around 18 m in height, typically forming a light, rounded crown. The trunk is usually short and knotted, with bark ranging from reddish-brown to greenish-grey. Young shoots are often greenish-grey and glossy, while one-year-old shoots are commonly greyish-brown, yellowish-brown, or greenish-brown. Buds are narrow to broadly triangular, varying from short to long and only rarely ovate.

Leaves are both simple or/and lobed. The occurrence of two or more distinct leaf shapes on the same plant is called heterophylly. The tendency to form lobed leaves depends on genotype as well as developmental stage, light penetration within the canopy and pruning management. A useful diagnostic feature is leaf hairiness. The the lower (abaxial) surface is glabrous or hairs are typically confined to the veins, while the upper (adaxial) surface is generally glossy. Leaf base is most often retuse; shallowly cordate or truncate forms are also frequent, while cuneate base is less common. The apex is usually acute or obtuse and only rarely obcordate. The leaf tip is most commonly acuminate, although it may also appear caudate or absent. Margins are most often crenate or serrate, and in some cases biserrate or dentate. Compared with black

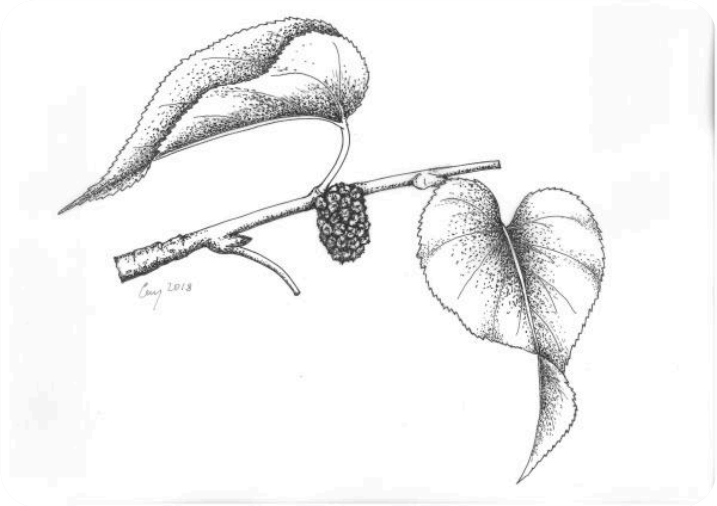
mulberry, *M. alba* tolerates pruning better and typically has smoother, softer leaves, which historically made it the preferred species for sericulture.
White mulberry also shows considerable variation in sexual expression. Inflorescences occur as male or female catkins and may be found on separate trees (dioecy) or on the same tree (monoecy), with occasional bisexual combinations. Male inflorescences are grouped in hanging catkins with four stamens, while female inflorescences are (semi-)erect and ovoid to ellipsoid shaped. The infructescences (soroses) vary widely in colour, ranging from yellowish-white and light pink to purple brown, dark red and black.



White mulberry (*Morus alba*) shoot with ovoid to ellipsoid shaped fruits and leaves (scheme: A. Ivančič)

Black mulberry

The black mulberry (*Morus nigra*) was brought to Europe from Middle East much earlier than the white mulberry, probably as far back as classical antiquity period. Black mulberry is quite rare in the continental regions of Europe and the data collected on its distribution is far from complete.
Its dark coloured fruits can easily be confused with those of the ‘dark’ genotypes of white mulberry. However, the crown is wider and thicker, and the trunk is twisted and knotted. Young shoots are strong, reddish brown and hairy. Compared to the white mulberry, the black mulberry has a uniformly hairy lower (abaxial) leaf surface. This gives the leaves a silvery shine. The upper leaf surface is dark green and rough. Leaves are broad, heart-shaped. Lobed leaves can also be present but are less common than in white mulberry. The flowers are unisexual catkins. The juicy fruits (soroses) are spherical, 1-3 cm long, greenish when unripe, gradually turning red and later dark purple, and are very aromatic when fully ripe.



Black mulberry (*Morus nigra*) shoot with characteristic conical buds, and hairy lower (abaxial) surface of the leaves. Spherical fruits are on short peduncles. (Scheme: A. Ivancic)

Dendrological and morphological differences between white and black mulberry

The crown of the white mulberry (*M. alba*) is lighter and more open and those of the black mulberry (*M. nigra*) is denser and more compact.

The triangular bud and greyish-green shoot of the white mulberry (*M. alba*) and on the right the reddish-brown shoot with dark conical bud of the black mulberry (*M. nigra*).

The lower (abaxial) side of the white mulberry leaf is glabrous (left) and that of the black mulberry leaf is hairy (right).

The white mulberry soroses (photo left) and those of the black mulberry, which have a very short stalk and a prolonged ripening period.

Methodology

Development of MorusAPP

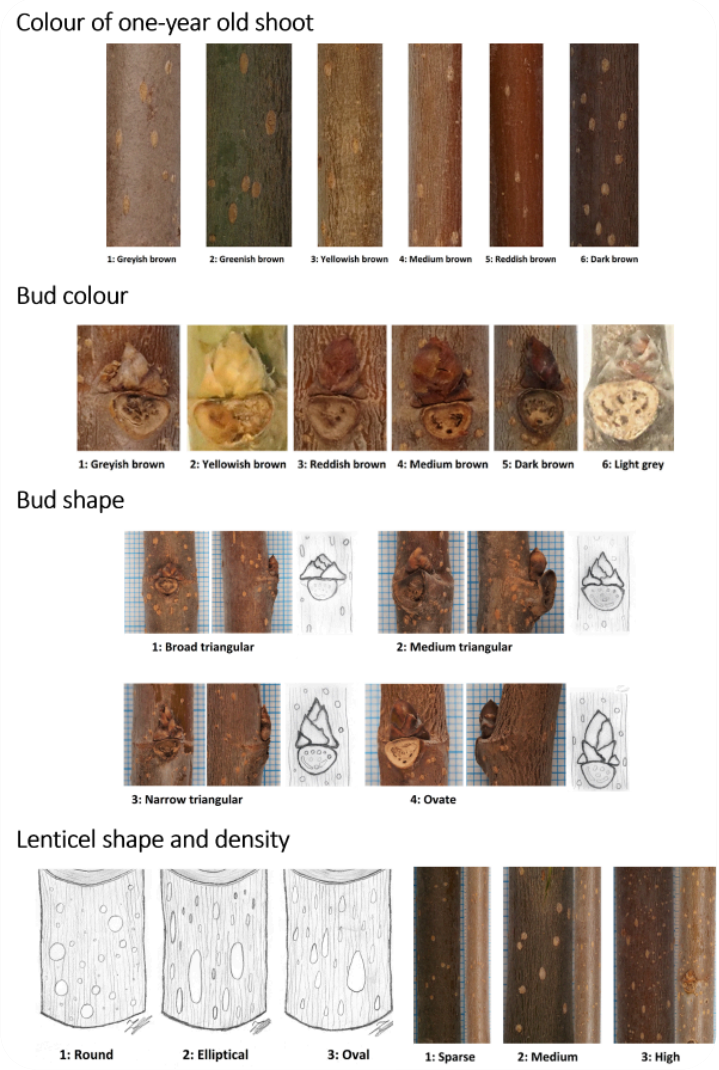
The application – ***Morus* APP** (Morus APP, 2023) was created with the aim of identifying old mulberry (*Morus* sp.) varieties in the different European countries by entering visual observations of individual mulberry trees. In the application, taxonomic and phytogeographical information, accessibility and number of trees, tree growth habit, tree vigour, pruning practices, trunk shape, morphological characteristics of shoots, leaves and reproductive structures, and observations on diseases and pests are recorded.
The application allows the user to enter and list specimens of mulberry trees found in the field throughout Europe.
Supporting schematic and pictorial information helps the user choose which specific parameters to enter. Descriptors, which are designed to create a comprehensive representation of an individual specimen, are provided with images / schemes and remarks for each option.

Mandatory descriptors to be entered in the application:

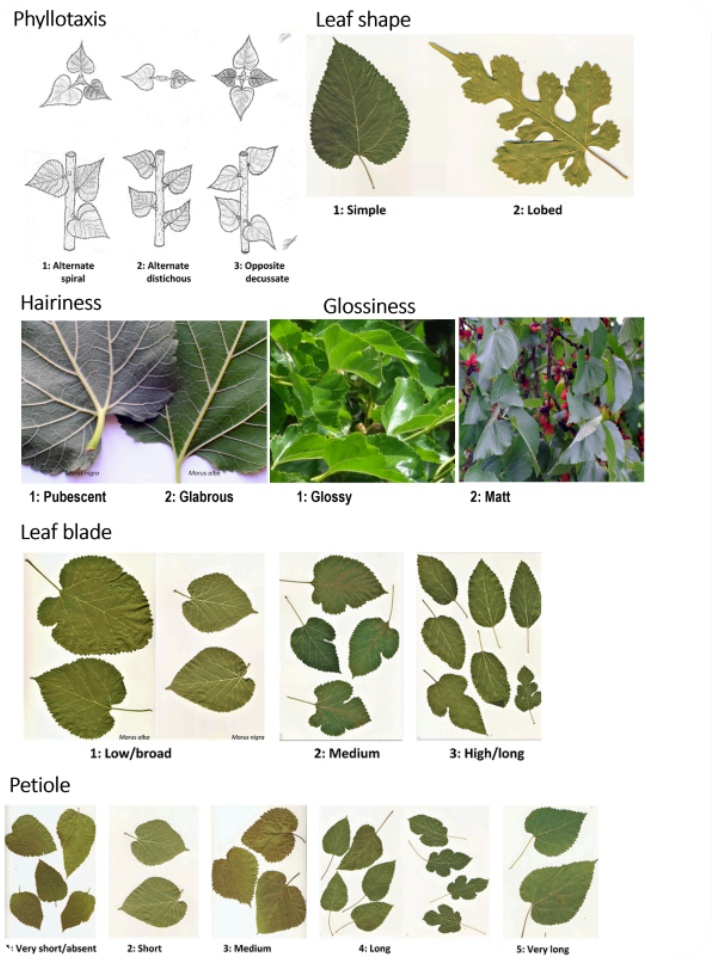
1.1 Species; 1.2 Identification number; 1.3 Accessibility; 1.4 Geographical origin; 1.5 Number of individuals at the location; 1.6 Tree growth habit; 1.7 Pruning management; 1.8 Tree vigour.

Non-mandatory descriptors:

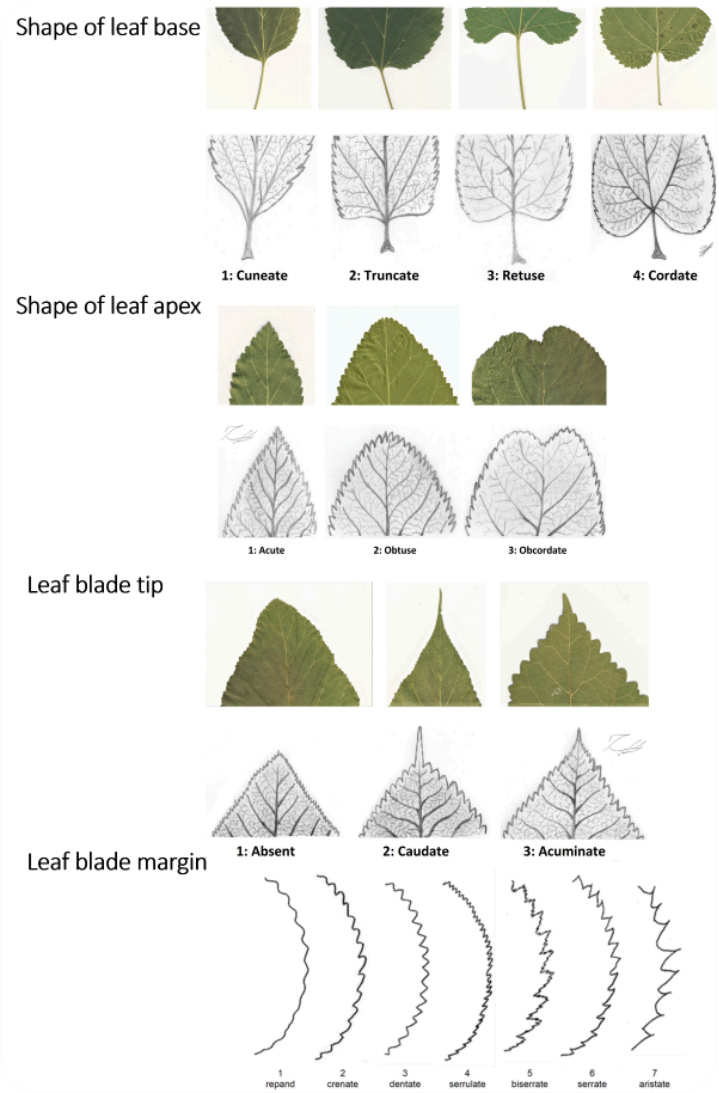
2.1 Varietal name; 2.2 Trunk circumference; 2.3 Tree growth habit; 2.4 Trunk, 2.4.1 Trunk colour, 2.4.2 Trunk irregularities / damage; 2.5 Shoots, 2.5.1 Colour of one-year-old shoot, 2.5.2 Lenticel density, 2.5.3 Lenticel shape, 2.5.4 Buds, 2.5.4.1 Shape, 2.5.4.2 Colour; 2.6 Leaves, 2.6.1 Phyllotaxis, 2.6.2 Leaf shape (lobation / heterophylly), 2.6.3 Leaf blade (ratio; length:width), 2.6.4 Petiole, 2.6.5 Shape of leaf base, 2.6.6 Shape of leaf apex, 2.6.7 Leaf blade tip, 2.6.8 Leaf blade margin, 2.6.9 Leaf hairiness (abaxial surface), 2.6.10 Leaf hairiness (adaxial surface); 2.7 Reproductive structures, 2.7.1 Sexual dimorphism, 2.7.2 Inflorescence shape, 2.7.3 Stigma persistency; 2.8 Infructescence, 2.8.1 Infructescence peduncle length; 2.8.2 Colour of infructescence; 2.8.3 Taste of infructescence, 2.8.4 Shape of infructescence, 2.8.5 Uniformity of infructescence ripening; 2.9 Diseases, 2.9.1 Fungal leaf spot, 2.9.2 Bacterial leaf spot/mulberry blight (*Pseudomonas syringae* pv. *mori*), 2.9.3 Soft rot (*Pectobacterium carotovorum*), 2.9.4 Ringspot virus; 2.10 Pests, 2.10.1 Mulberry moth (*Hyphantria cunea*), 2.10.2 Thrips (five species), 2.10.3 Scale insects (*Hemiptera*), 2.10.4 Mealy bugs (*Maconellicoccus hirsutus*), 2.10.5 Hairy caterpillar (*Spilarctia obliqua*), 2.10.6 Jassids (*Empoasca flavescens*).



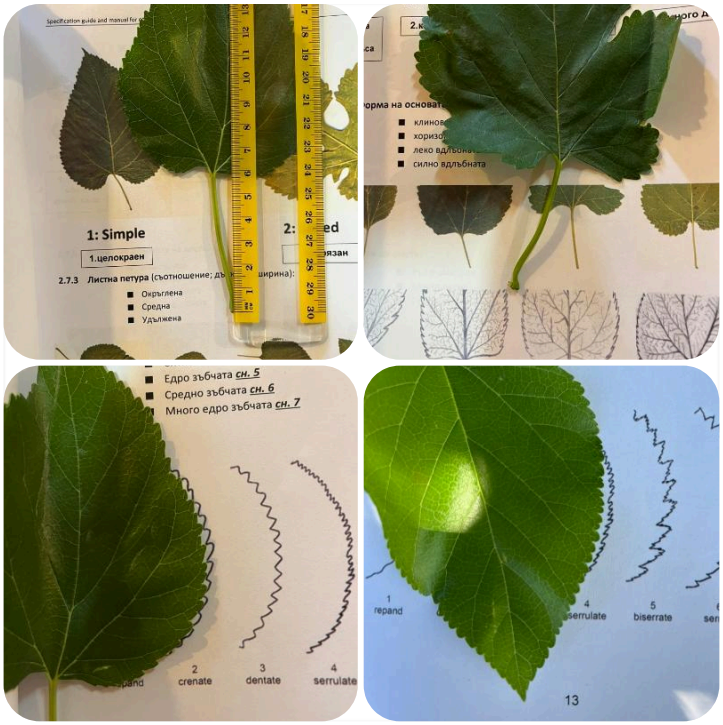
Morphological characterization of the one-year old shoots and buds. Colour of the one year old shoot, bud colour, bud shape, lenticel shape and density.



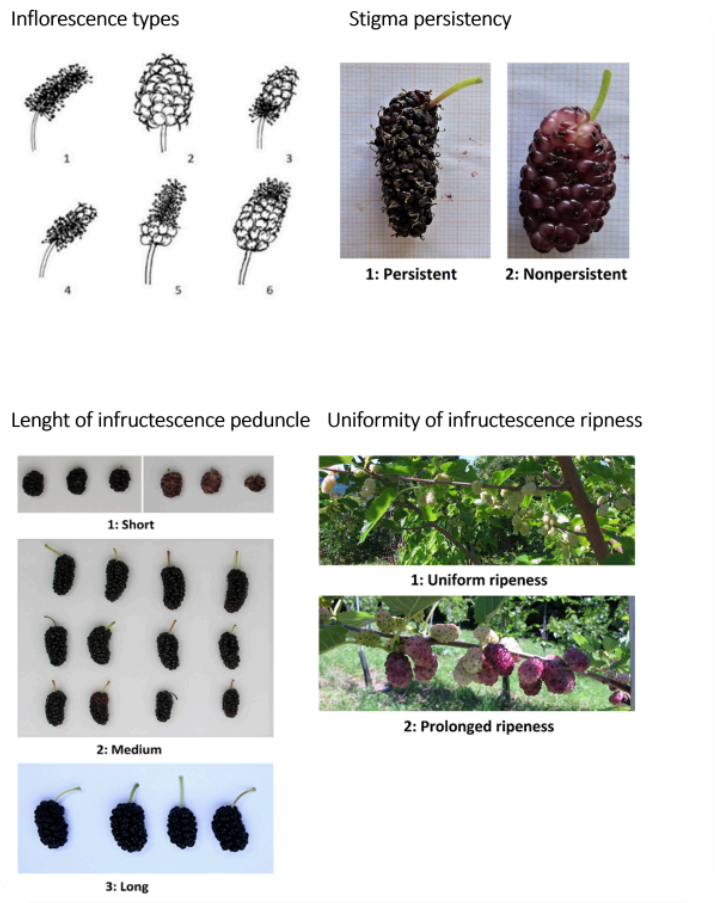
Morphological characterization of the leaves. Phyllotaxis, leaf shape, hairiness, glossiness, leaf blade, petiole.



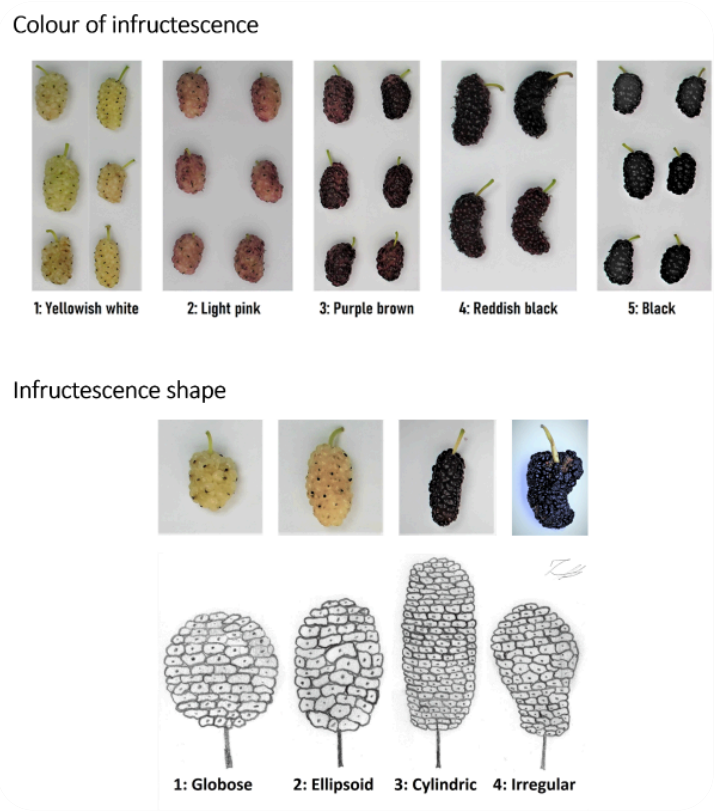
Morphological characterization of the leaves. Shape of leaf base, shape of leaf apex, leaf blade tip, leaf blade margin.



Example of leaf morphological descriptors' evaluation using the "Guidance model to collect mulberry samples" (BG_00614, Belitsa, Bulgaria, 324 cm).



Morphological characterization of the reproductive tructures. Inflorescence types, stigma persistency length of infructescence peduncle, uniformity of infructescence ripness.



Morphological characterization of the reproductive structures. Colour of infructescence, infructescence shape.

Sampling procedure of mulberry trees

Field excursions were performed to sericultural regions of ARACNE partners on clear days from April 2023 to mid-November 2025. Users recorded the exact GPS locations and measured stem circumference at breast height (CBH >300 cm). If the tree is of low form or irregularly shaped, the circumference was individually measured at representative height. In addition to morphological evaluation a short shoot tip with young leaf preserved in a tube with silica gel was picked for further genetic analyses.

Details on the sampling procedure and descriptor monitoring using Morus APP are provided in Deliverable D1.3, "Guidance Model to Collect Mulberry Samples" (2023).
Details on the Report on the collected mulberry trees along with genetic are provided in Deliverable D1.4, "Report on the collected mulberry samples" (2024) and in Progress report on the collected mulberry samples (2025) (not yet available).

General inventory report

Currently, **138 users from ten countries** (Italy, Slovenia, Spain, Greece, Georgia, France, Bulgaria, Austria, Germany, India) are registered to Morus APP. Silvia Cappellozza (CREA, Italy), Gianni Fila (CREA, Italy) and Andreja Urbanek Krajnc (UM, Slovenia) are designated superadministrators, 25 users act as administrators and others as editors. See ***Morus* APP** for updated numbers. Between 2023 and 2025, a total of 1256 mulberry trees were recorded in the European landscapes via the Morus APP and verified by the UM project team (Figure general_ 1). In general, the majority of mulberry trees recorded (94 %, 1184) were identified as *M. alba* (Figure general_ 3A) a minority of 5% (59) as *M. nigra* (Figure general_ 3B). Thirteen trees (1%) were identified only at the genus level (*Morus* sp.).

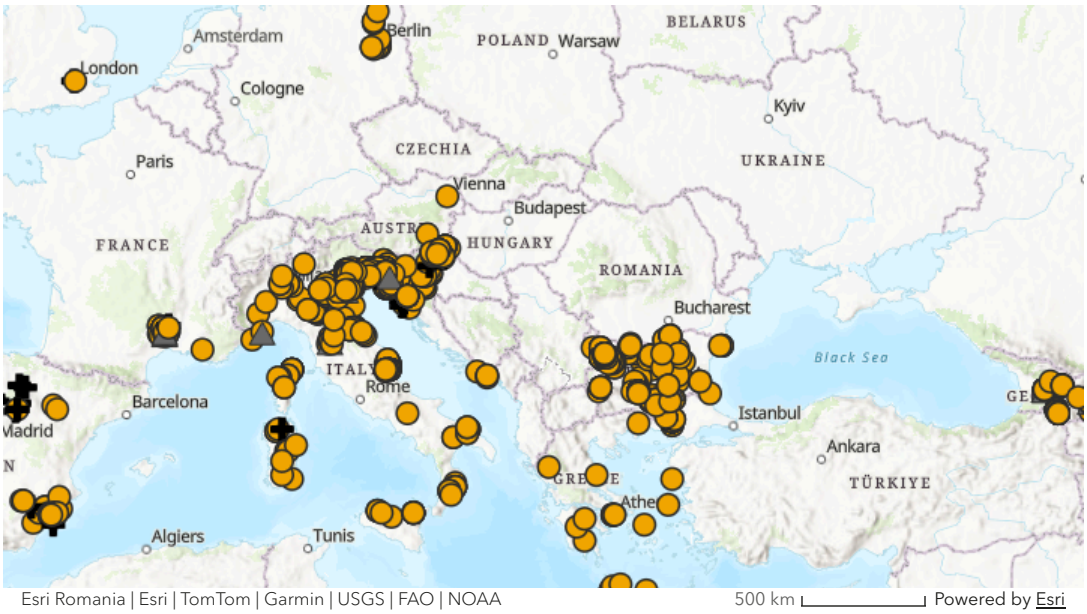


Figure general_ 1 - Mulberry distribution map. Trees were recorded in Austria, Bulgaria, Croatia, France, Georgia, Germany, Greece, Italy, Slovenia, Spain and the United Kingdom using Morus App. *M. alba* (orange circles), *M. nigra* (black crosses), *Morus* sp. (grey triangles).

Most mulberry trees (*M. alba*. *M. nigra*, *Morus* sp.) were recorded in Italy (378, 30%) and Slovenia (376, 30%), followed by and Bulgaria (180, 14%), Spain (102, 8%), Georgia (81, 6%), France (46, 4%), Greece (43, 3%), Croatia (29, 2%) Germany (16, 1%), and 5 trees from other countries (Figure general_ 2A).
One third of all *M. alba* were recorded in Slovenia (359, 30%) and Italy (371, 31 %) each, followed by Bulgaria (177, 15%), Spain (85, 7%), Georgia (76, 6%), France (41, 3%), Greece (40, 3%), Germany (16, 1%), Croatia (16, 1%) and 3 trees from other countries (Figure general_ 2A).
Morus nigra was represented by 59 trees (5 % of total), with the majority recorded in Spain (17, 29 %), followed by Slovenia (15, 25%), Croatia (13, 22%), Greece (3, 5%), France (3, 5%), Bulgaria (2, 3 %), United Kingdom (2, 3 %), and Georgia (2, 3 %) (Figure general_ 2B).

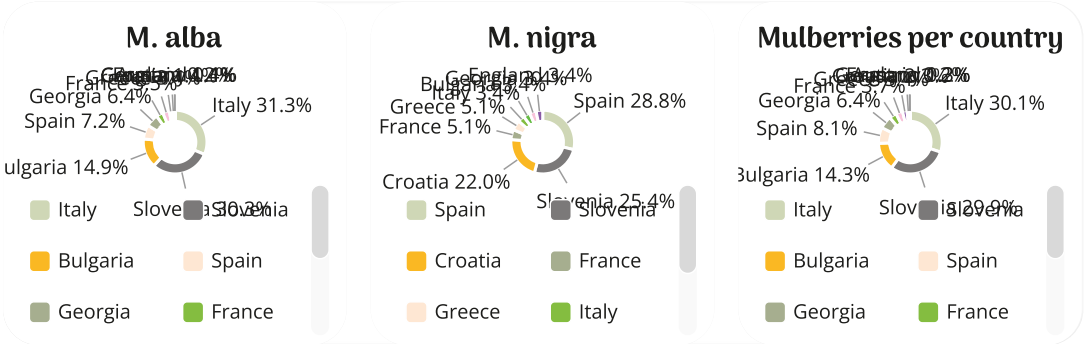


Figure general_ 2 – Contribution of countries to the inventory of A) *Morus alba* and B) *M. nigra* trees using Morus APP. Data show percentage of monitored trees.

Details on the general inventory report of mulberry trees are available in Progress report on the collected mulberry samples (2025).

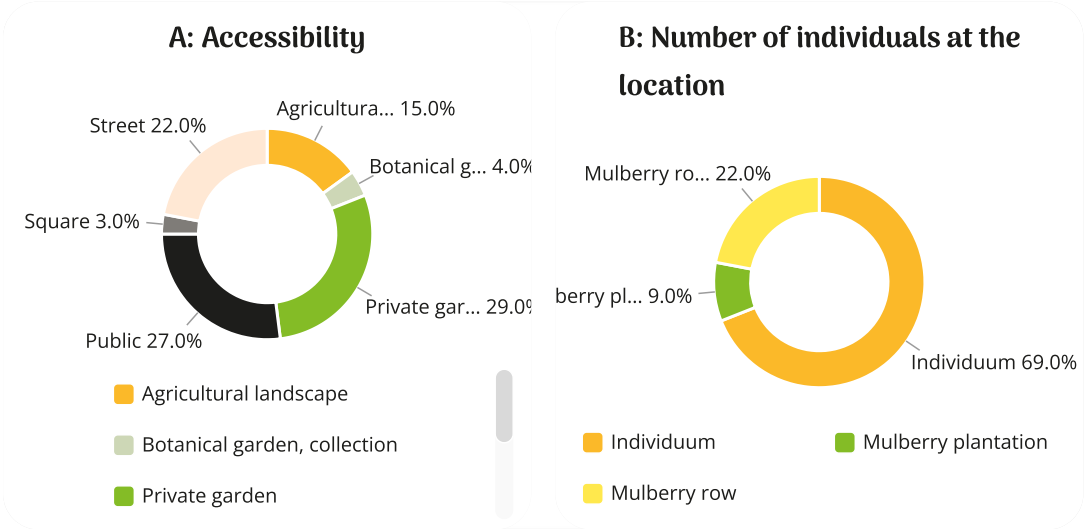
When assessing accessibility, most mulberry trees were located in settings that are easy to reach for the general public. The largest share was recorded in private gardens (29%), followed

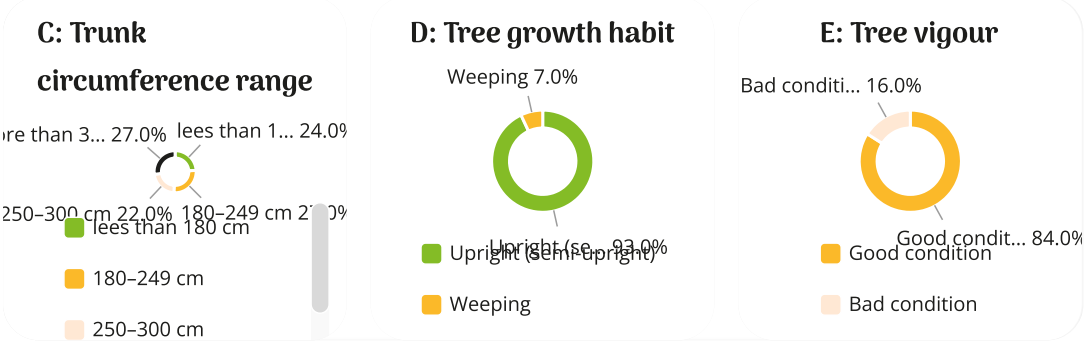
by public areas (27%), along streets (22%), and in agricultural landscapes (15%). Only a small proportion was found in botanical gardens or curated collections (4%) and in squares (3%). The mulberry germplasm collections of CREA, IMIDA, Vratsa, and UM were excluded from this assessment (Figure General_3A). 69 % of mulberries grow individually, while 22% reported mulberry locations were represented by mulberry rows and 9% plantations (Figure general_ 3B).

In the distribution of mulberry trees according to their circumference, the mulberry trees were relatively homogeneous, with most size classes equally represented. Only the trees with a trunk circumference between 250 and 300 cm showed a slightly lower proportion, comprising 22% of the total (Figure general_ 3C).

The inventory of mulberries by tree growth habit (Figure general_ 3D) indicated that majority (93%) of the recorded trees grew upright or semi-upright, while only 7% had a weeping growth habit. Figure general_ 3E shows that 84% of mulberries were in good condition, while 16% (N=190) were in bad condition. Figure general_ 3F shows pruning practices of the mulberries. Half of trees were unpruned, 26% were pruned yearly and 24% frequently.

The predominant trunk colour among the recorded mulberries, representing 67%, was greyish-brown. The trunk of 23% trees was light brownish grey and minority (10%) had dark brown trunk colour (Figure general_ 3G).





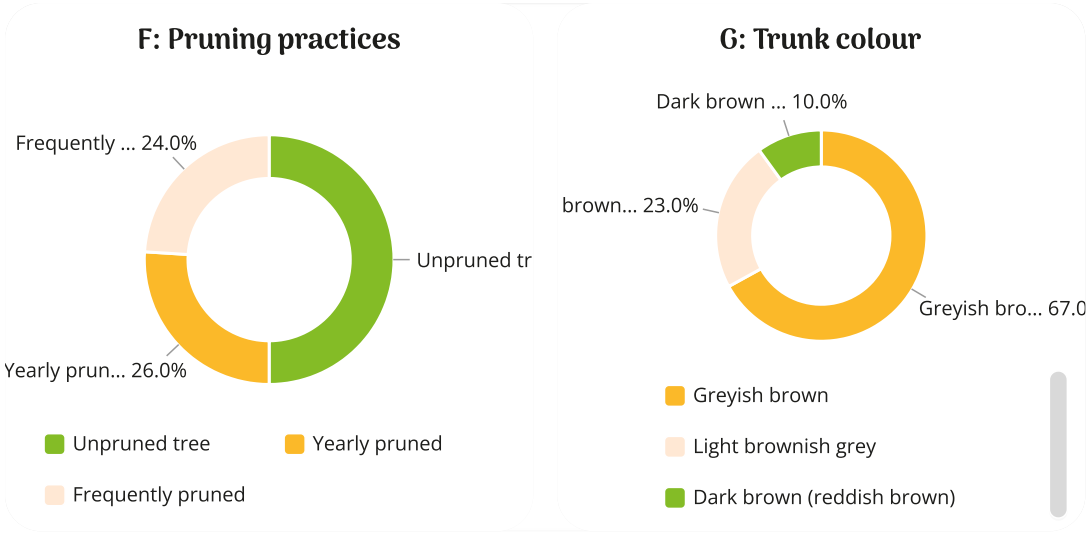


Figure general_ 3– Basic information on the recorded mulberry trees from all countries (Austria, Bulgaria, Croatia, France, Georgia, Germany Greece, Italy, Spain, Slovenia, United Kingdom). A) Accessibility options of trees. B) State on the number of individuals at location. C) Percentage of trees at certain trunk circumference range. D) Percentage of trees of upright and weeping growth habit. E) Percentage of trees in bad and good condition. F) Report on the pruning frequency of the trees. G) The percentage of trees of different trunk colours.

General report on pest and disease

Besides collecting the basic information as well as morphological characteristics of shoots, leaves and reproductive structures on inventories mulberry trees, we also performed observations on diseases and pests, which we report in general in Figure general_ 4.

The disease observations were focused on identifying leaf necrosis and bark lesions, which require microscopic or genetic analyses for definitive diagnosis. Bacterial blight, caused by *Pseudomonas syringae* pv. *mori*, was frequently observed, alongside other pathogens such as *Pectobacterium carotovorum*, ringspot virus, and various fungi (*Epicoccum nigrum*, *Alternaria alternata*, and *Phloeospora maculans*). Mulberry yellow dwarf disease (MYD), attributed to *Candidatus Phytoplasma asteris*, has been a longstanding issue in Georgia since the 1960s, spreading via infected planting material and the mulberry cicada.

Pest observations revealed that the most common pest noted was the pink mealybug (*Maconellicoccus hirsutus*, Pseudococcidae – Pink Mealybug), primarily affecting the bark of younger trees. In Greece, severe infestations of the Asian wood borer (*Xylotrechus chinensis*, Cerambycidae – Tiger Longicorn Beetle) were reported on larger trees, a pest that also affects other fruit crops and has recently been added to the EPPO Alert List (Eppo, 2024) due to its potential impact.

Figure general_ 4A shows the incidence of leaf necrosis among a total of 166 observed mulberries from all countries. The majority (54 %) of leaves exhibited low leaf necrosis, while 31 % displayed medium necrosis, and 15 % showed a high frequency of leaf necrosis. Figure general_4B shows the frequency of bark lesions in 109 observed mulberries. The majority (79 %), exhibited few bark lesions, while 21 % displayed a frequent occurrence of bark lesions.

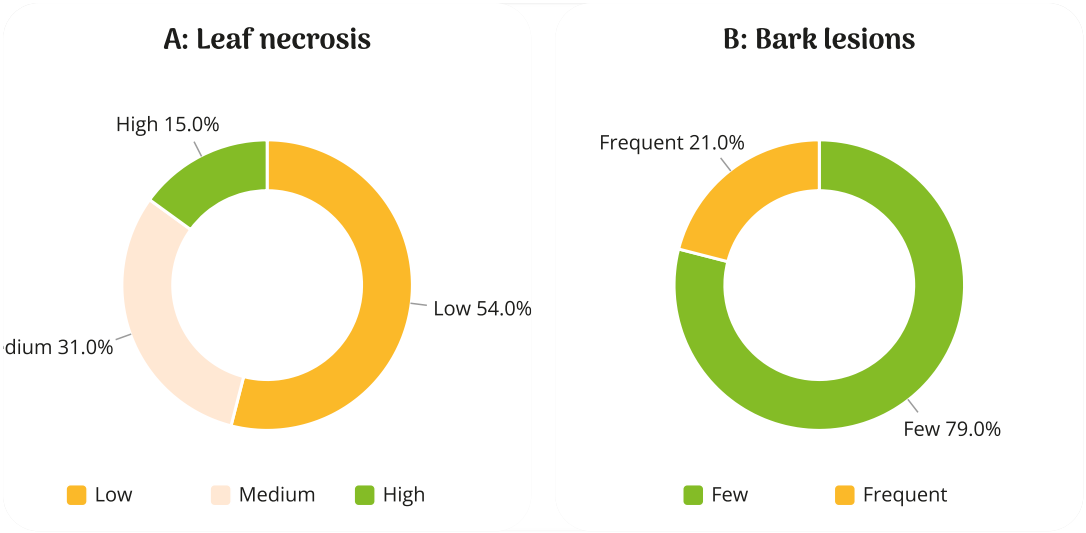
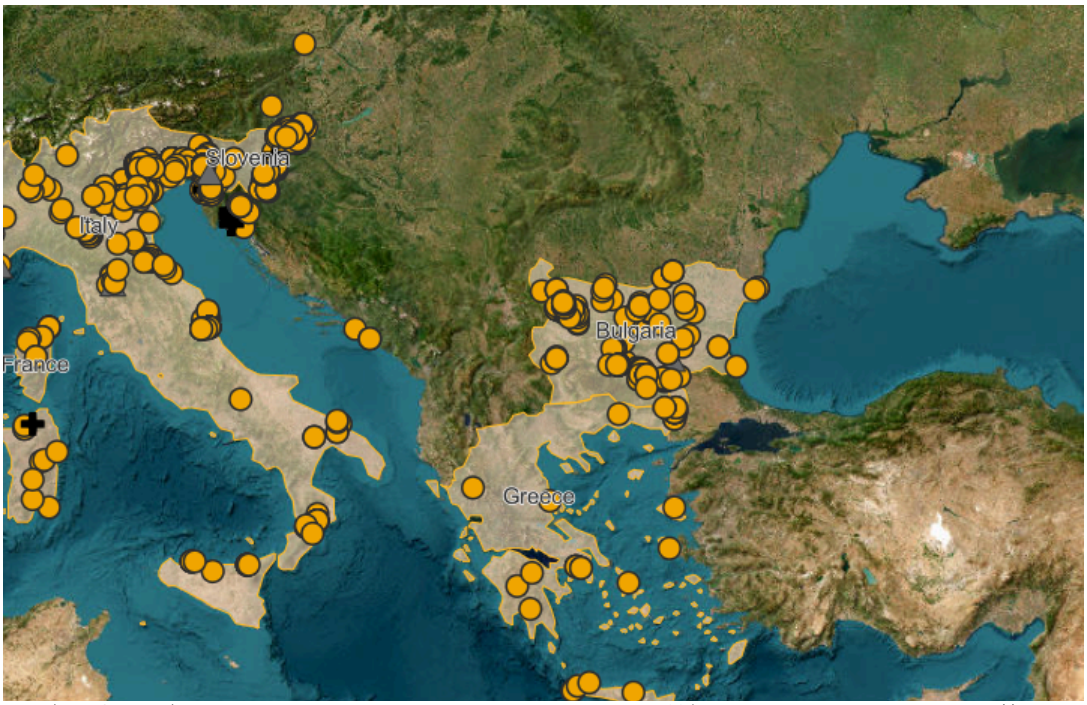


Figure general_ 4- Inventory of diseases of mulberries from all countries (Austria, Bulgaria, Croatia, France, Georgia, Greece, Italy, Spain, Slovenia, UK). A) Leaf necrotic spots. B) Bark lesions.

Mulberry Footprints Across Countries



Report on the inventory of mulberries in Italy

From 2023 to 2025, a total of 378 mulberry trees from Italy were recorded via the *Morus* APP. Inventory of Italian mulberries by species indicates that a majority of recorded trees were white mulberries (*M. alba*) with a total of 371 (98%), while there were five (1.1%) undefined *Morus* sp. and two black mulberry (*M. nigra*, 0.5%) trees (Figure IT_ 1A).

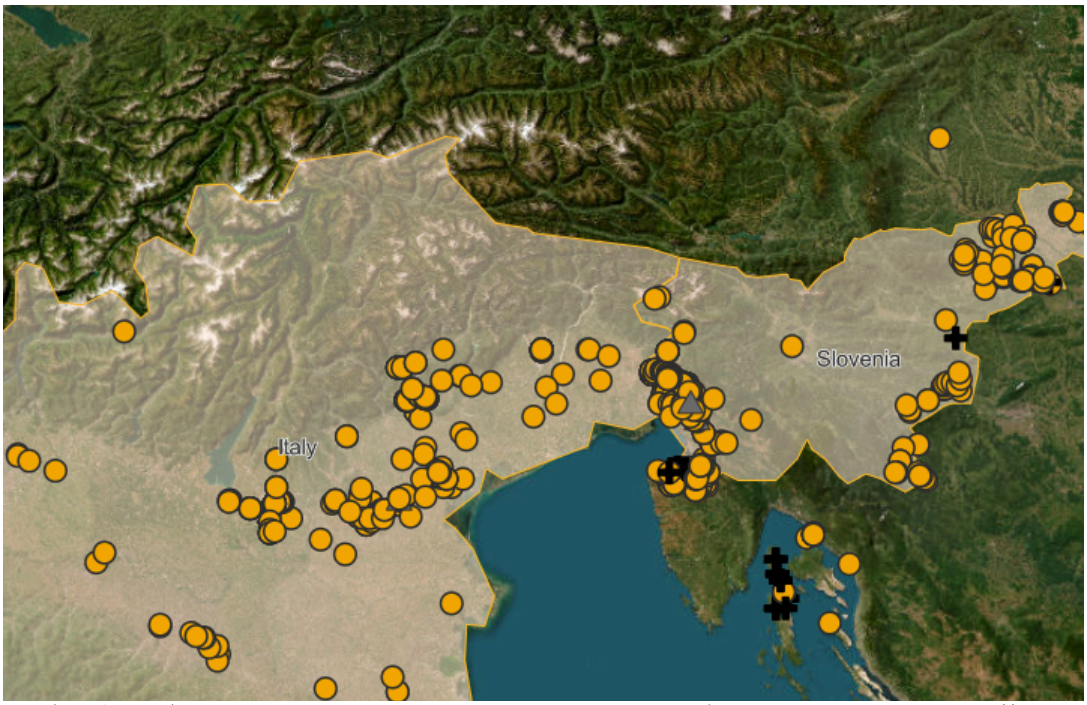
Figure IT_ 1B shows the accessibility options of mulberries recorded in Italy. The majority were grown in in public areas (27%). The second most common were mulberries in private gardens (26%), and the third most common were mulberries along streets (22%) and in agricultural areas (14%), while 7% were found in botanical gardens or collections, and only 3% in squares. Half of the mulberries in Italy grew individually (53%), while users recorded one third (32%) in mulberry rows and 15% in plantations (Figure IT_ 1C).

The distribution of mulberries based on circumference was predominated by more than half by trees (53%) featuring a very large circumference, exceeding 300 cm, followed by trees ranging from 250 to 300 cm (21%), trees ranging from 180 to 249 cm circumference (21%) and those with a circumference less than 180 cm (8%) (Figure IT_ 1D).

The inventory of mulberries by tree growth habit indicated that almost all (98%) of the recorded trees grew upright or semi-upright, while only one tree (2%) had a weeping growth habit (Figure IT_ 1E). Seventy-seven percent of mulberries recorded in Italy were in good condition, only a minority of trees (23%) were in bad condition (Figure IT_ 1F).

Figure IT_ 1G shows the pruning practices of the mulberries recorded in Italy. Pruning practices were distributed fairly equal between frequently pruned (34%), yearly pruned (34%) and unpruned (32%) trees. This means, a significant portion, comprising more than two thirds of the trees is getting pruned.

The predominant trunk colour among the recorded mulberries, representing 52%, was greyish-brown. Additionally, 27% showed a light brownish-grey trunk colour, while 21% featured a dark brown (reddish-brown) trunk colour (Figure IT_ 1H).



Report on the inventory of mulberries in Slovenia

From 2023-2025, Slovenian users recorded 376 mulberries within different Slovenian ecogeographical regions and an additional 46 mulberries abroad [in Austria (1), Croatia (16), United Kingdom (3), Italy (8), and Greece (28)]. Most of the trees (274) were recorded during the sampling excursions in June 2023, in order to monitor also the infructescence descriptors. Basic descriptors were recorded for all of the 376 mulberries, while other descriptors were recorded according to the possibilities of sampling. Slovenia recorded the most black mulberry trees among all participating countries in Slovenia (15 trees of the total) and the third-most in Croatia (13 trees of the total).

Inventory of mulberries by species indicates that a majority of recorded trees were white mulberries (*M. alba*) with a total of 359 (95%), while there were only 15 (4%) black mulberries (*M. nigra*) and two (1%) undefined *Morus* sp. (Figure SI_1A).

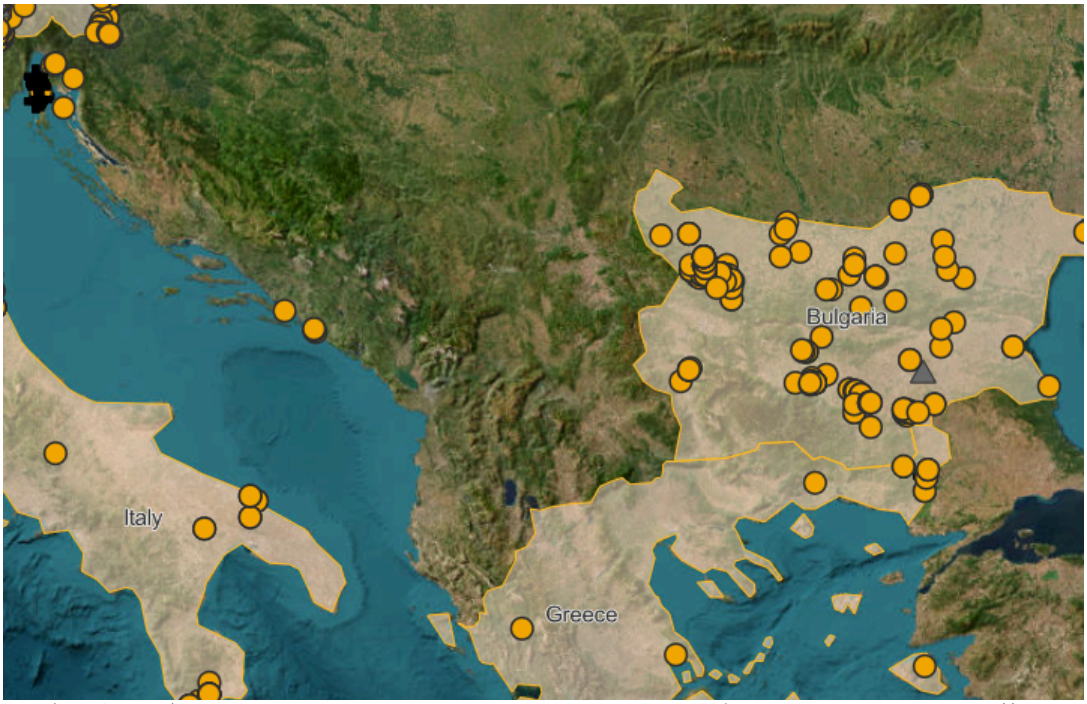
Figure SI_1B shows the accessibility options of mulberries recorded in Slovenia. The majority were grown in private gardens (43%). The second most common were mulberries in public areas (27%), and the third most common were mulberries in agricultural areas (19%), while 9% were found along the streets, only 1% in botanical gardens or collections, and 1% in squares. The majority of mulberries in Slovenia grew individually (84%), while we recorded 30 mulberry rows and 30 plantations, accounting for 8% each. Under plantations more then three ancient trees ordered as extensive plantation were categorised (Figure SI_1C). Farmers are currently establishing intensive plantations for sericultural activities. There are approximately 10 plantations, each comprising between 50 and 500 trees.

In total, sixty-four percent of all recorded mulberries in Slovenia had a diameter of less than 249 cm. Mulberry trees with smallest circumference, i.e., less than 180 cm, were the most prevalent, constituting 36% of all recorded mulberries. Twenty-eight percent of mulberries had diameters ranging from 180 to 249 cm. Additionally, there was an equal percentage (18%) of trees with diameters ranging from 250 to 300 cm and those exceeding 300 cm (Figure SI_1D). The majority of recorded trees in Slovenia had a smaller circumference compared to those in neighboring Italy. This discrepancy could be explained by the significant reduction of mulberry trees during the post-war period in the mid-20th century in Slovenia.

The inventory of mulberries by tree growth habit indicated that a majority of the recorded trees grew upright or semi-upright (94%), while only 6% of trees had a weeping growth habit (Figure SI_1E). The majority of mulberries recorded in Slovenia were in good condition, only a small minority of trees were in bad condition (Figure SI_1F).

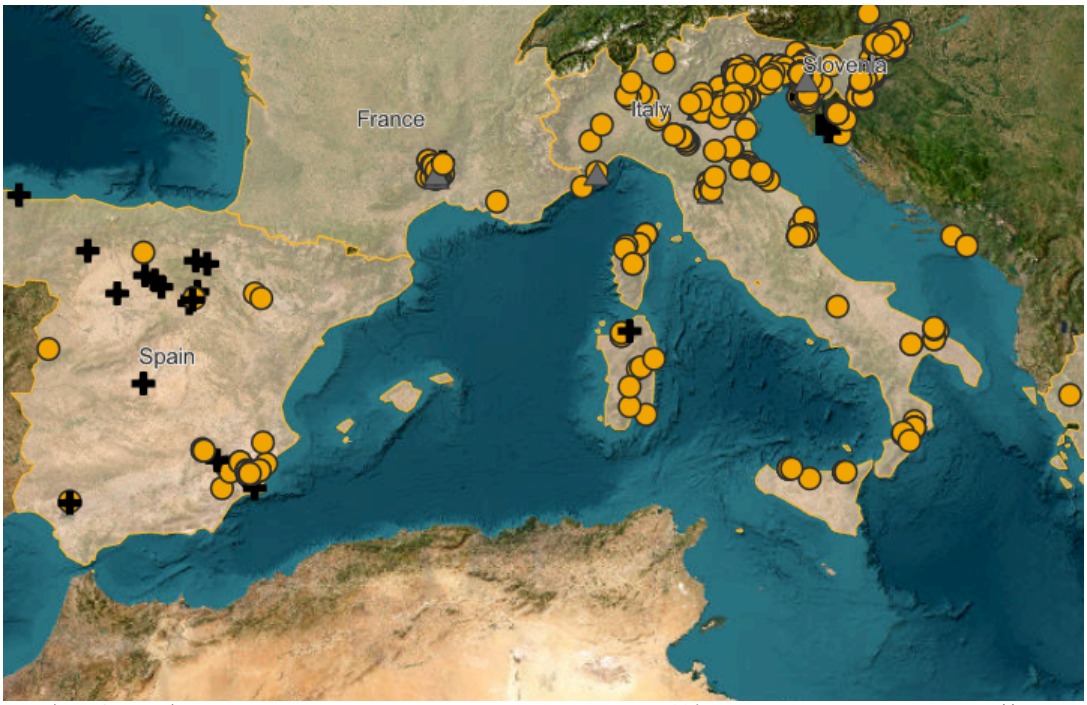
Figure SI_1G shows the pruning practices of the mulberries recorded in

Slovenia. A significant portion, comprising 54%, appeared to be unpruned. In contrast, 30% were subjected to yearly pruning, while 16% underwent frequent pruning.
The predominant trunk colour among the recorded mulberries, representing 69%, was greyish-brown. Additionally, 15% showed a dark brown (reddish-brown) trunk colour, while 17% featured a light brownish-grey trunk colour (Figure SI_2H).



Report on inventory of mulberries in Bulgaria

From 2023-2025, a total of 180 mulberry trees were recorded in Bulgaria via the *Morus* APP. The majority of recorded trees were white mulberries (*M. alba*) with a total of 177 trees (98%), while there were only two black mulberry trees (*M. nigra*) and one *M. indica* (Figure BG_ 1A).
Assesing the accessibility options of mulberries revealed that the majority were found along the streets (53%). The second most common were mulberries in public areas (20%), and the third most common were mulberries grown in private gardens (14%). Only 8% were found in agricultural areas and 3% in squares. In botanical gardens or collections 2% of trees were recorded (Figure BG_ 1B). The majority of mulberries in Bulgaria grew individually (83%), while we recorded 13% of trees in mulberry rows and only 4% in plantations (Figure BG_ 1C).
Thirty-six percent of the mulberry trees had a very large trunk circumference exceeding 300 cm, followed by trees with a circumference of 250–300 cm (33%) and 180–249 cm (30%). Only 1% of the trees had a circumference below 180 cm (Figure BG_ 1D). The inventory of mulberries by tree growth habit indicated that a majority of the recorded trees (99%) grew upright or semi-upright (Figure BG_ 1E). The majority of mulberries (93%) were in good condition (Figure BG_ 1F).
The recording of pruning practise revealed that two thirds of the recorded mulberries are left unpruned (67%). Twenty-two percentage of trees were frequently pruned and a minority (11%) were yearly pruned (Figure BG_ 1G).
The predominant trunk colour among the recorded mulberries, representing 92%, was greyish-brown, while 6% featured a light brownish-grey trunk colour and 2% dark brown colour (Figure BG_ 1H).



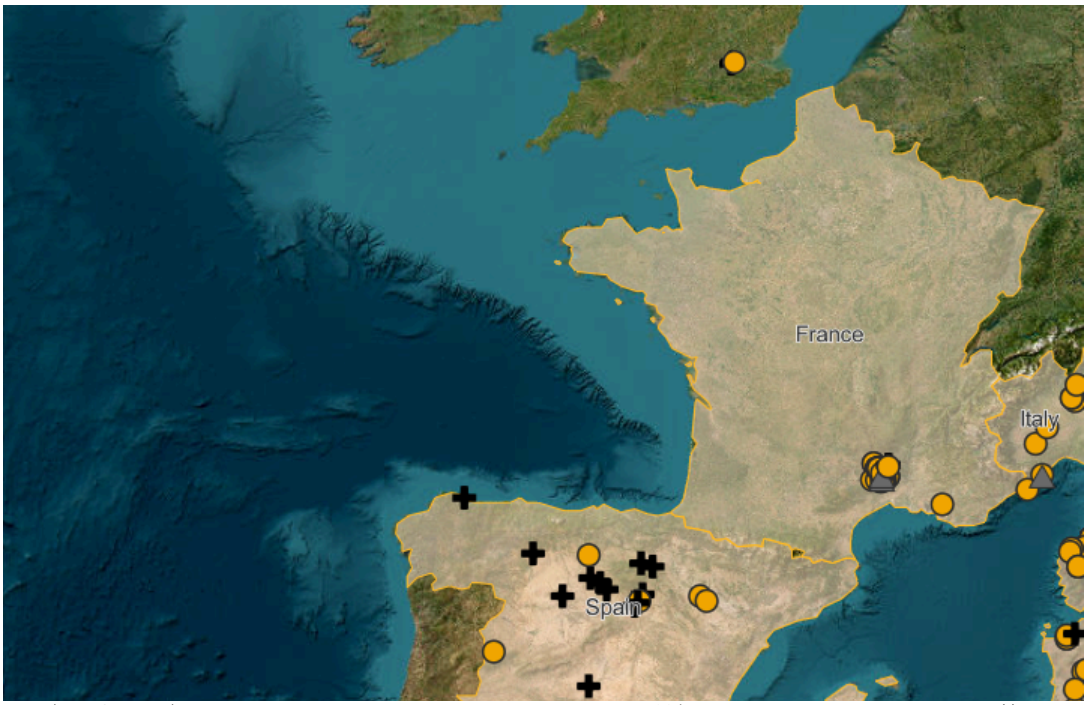
Report on inventory of mulberries in Spain

From 2023-2025, a total of 102 mulberry trees were recorded in Spain via the *Morus* APP. The inventory of Spanish mulberries by species showed that 83% of the recorded trees were white mulberries (*Morus alba*); in addition, 17% monumental black mulberry trees (*Morus nigra*) were identified (Figure ES_1A), indicating that Spain recorded the highest number of black mulberries among all participating countries.

Figure ES_1B presents the accessibility categories of mulberry trees recorded in Spain. Most trees were located in public areas (39%), followed by private gardens (25%) and streets (25%). Smaller shares were recorded in agricultural areas (8%), while collections accounted for only 1%. Three quarters of the mulberry trees grew individually (75%), while 24% occurred in mulberry rows. Only 2% were recorded in plantations (Figure ES_1C).

Forty-nine percent of mulberry trees had a very large circumference of more than 300 cm, followed by 43% featuring a circumference of 250-300 cm, 5% with a circumference between 180-249 cm and 3% below 180 cm (Figure ES_1D). The inventory of mulberries by tree growth habit indicated that almost all (99%) of the recorded trees grew upright or semi-upright and one percent grew weeping (Figure ES_1E). Almost all (91%) of the mulberries recorded in Spain were in good condition, only nine percent were in bad condition (Figure ES_1F).

Figure ES_1G shows the pruning practices of the mulberries recorded in Spain. Half of the recorded mulberries were unpruned (56%), 23% were frequently pruned and 21% were yearly pruned. This distribution provided insight into the varied mulberry maintenance practices. Seventy-six percent of the recorded mulberries featured a greyish brown trunk colour, 24% a light brownish-grey trunk colour (Figure ES_1H).



Report on inventory of mulberries in France

From 2023-2025, a total of 46 mulberry locations of individual trees, rows and three plantations (Mercoire, Saint-Martin Bourg, Maison Rouge) in France were recorded via *Morus* APP. Inventory of French mulberries (Figure FR_1) by species indicates that 89% recorded locations were white mulberries (*M. alba*, Figure FR_1A). Seven percent of trees were black mulberry trees found in Cevennes, two old specimens in the village of Mercoire and one young tree planted in front of Maison Rouge museum. At eight locations on Corsica and in Bonnet (Cevennes), four to fourteen *M. alba* f. *macrophylla* (Moretti) C.K.Schneid. (synonym *M. alba*) were used as shade trees around boule fields, parking areas and along streets. This form of white mulberry with plane-like leaves is used to replace plane, which suffers a dramatic loss due to disease caused by canker stain of plane (Ceratotystis platani, EPPO 2025). Most disastrous plane clearings of thousands of trees had to be carried out along the famous Canal du Midi, which connects Tolouse to the Mediterranean Sea.

Figure FR_1B presents the accessibility categories of mulberry trees recorded in France. Approximately one quarter of the trees were located in public areas (26%) and collections (24%). A further 22% were found in private gardens, and 22% along streets. Smaller shares were recorded in squares (4%) and agricultural landscapes (2%). Regarding growth arrangement, most mulberries in France occurred either as individual trees (31%) or in mulberry rows (40%), while 29% were recorded in plantations (Figure FR_ 1C).

Half of the recorded trees had a circumference below 180 cm (53 %), followed by one-third (28%) with 180-249 cm, while a small percentage (15 %) had either a large circumference of 250 to 300 cm or a very large circumference of more than 300 cm (7 %) (Figure FR_1D).

The inventory of mulberries by tree growth habit indicated that 98% of the recorded trees grew upright (Figure FR_1E). A majority of mulberries recorded in France was in good condition (84 %), some trees (16 %) were in bad condition (Figure FR_1F).

Figure FR_1G shows the pruning practices of the mulberries recorded in France. Half (57%) of the recorded mulberries were yearly pruned. One-third was unpruned (28%). A few recorded trees (22%), were frequently pruned.

The predominant trunk colour among the recorded mulberries, representing 60% was greyish brown, one-third (37%) was light brownish grey, while a few (3%) featured a dark brown (reddish-brown) trunk colour (Figure FR_1H).

Report on inventory of mulberries in Greece

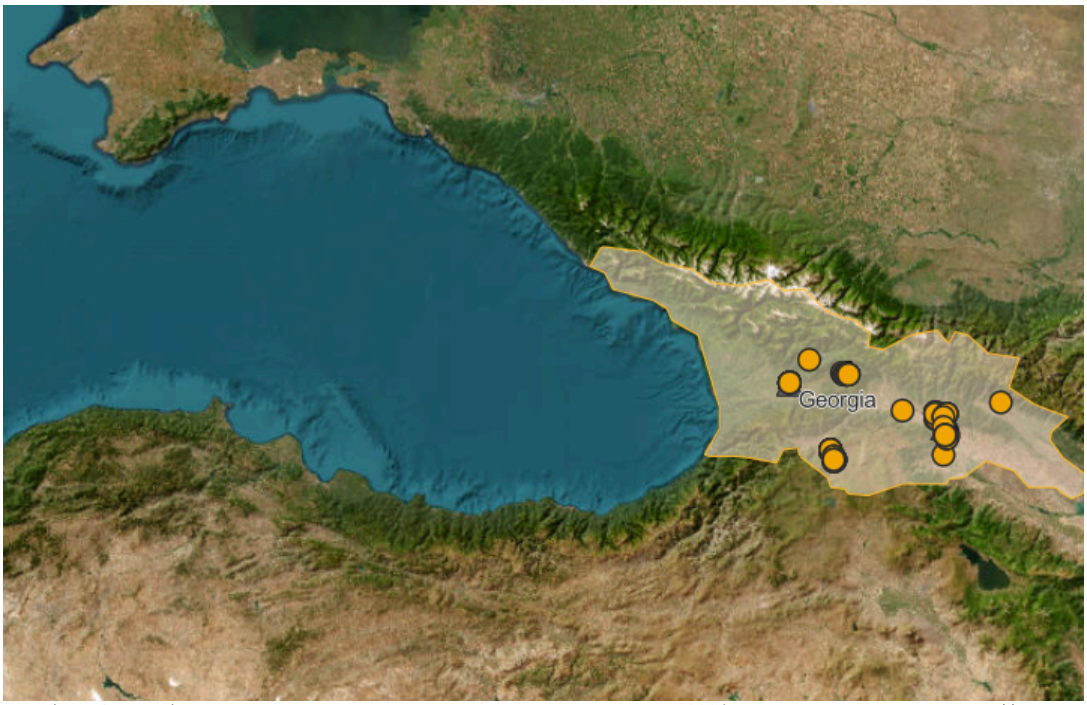
From 2023-2024, a total of 42 mulberry trees from Greece were recorded via the *Morus* APP. Inventory of Greek mulberries by species represented in Figure GR_ 1A indicates that most recorded trees were white mulberries (*M. alba*) (85%), while there were only four (10%) black mulberries (*M. nigra*) and two mulberries identified at genus level (*Morus* sp.).

Figure GR_ 1B shows the accessibility options of mulberries recorded in Greece. A slight majority were found in private gardens (34%). The second most common were mulberries along the streets and agricultural areas (21% each), while 17% were recorded in public areas. Only 7% were found in botanical gardens or collections. None were found in squares. Most mulberries in Greece grew individually (55%), while we recorded 24% in mulberry plantations and 21% in mulberry rows (Figure GR_ 1C).

The distribution of mulberries based on circumference revealed 45% trees with a circumference below 180 cm and 33% trees with a circumference between 180-249 cm. Sixteen percent of all recorded mulberries in Greece had a very large circumference of more than 300 cm and only 6% had a large circumference of 250 to 300 cm (Figure GR_ 1D).

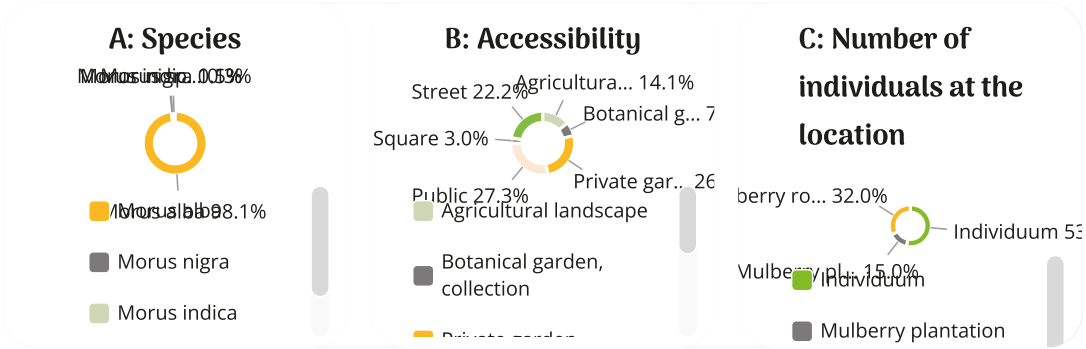
The inventory of mulberries by tree growth habit indicated that a majority of the recorded trees grew upright or semi-upright (94%), while 6% had a weeping growth habit (Figure GR_ 1E). A large majority of mulberries recorded in Greece was in good condition (90%), a minority of trees (10%) were in bad condition (Figure GR_ 1F).

Figure GR_ 1G shows the pruning practices of the mulberries recorded in Greece. Half of the recorded mulberries were frequently pruned (50%), 40% were unpruned, and a minority (10%) were yearly pruned. The predominant trunk colour among the recorded mulberries, representing 74%, was greyish-brown, while 26% featured a light brownish-grey trunk colour (Figure GR_ 1H).



Report on inventory of mulberries in Georgia

The inventory of Georgian mulberries by species showed that the majority of the 81 recorded trees (94%) were white mulberries (*Morus alba*). Three trees were identified only at the genus level (*Morus* sp.), and two were recorded as black mulberries (*Morus nigra*) (Figure GE_1A).
Figure GE_1B shows the accessibility options of mulberries recorded in Georgia. The majority (35%) was found in agricultural areas, followed by private gardens (27%) and public areas (23%). A few were recorded along streets (10%) and in squares (5%) (Figure GE_1C). Forty-eight percent of mulberries in Georgia grew individually, while we recorded 31% in rows and 21% in mulberry plantations (Figure GE_1C). One-half (50%) of the mulberry trees had a circumference between 180 and 249 cm, 29% featured a circumference below 180 cm, followed by 11%, which featured a circumference of 250-300 cm and 10% with more than 300 cm circumference (Figure GE_1D). The inventory of mulberries by tree growth habit indicated that amost all of the recorded trees grew upright or semi-upright (92%), a few weeping (8%) (Figure GE_1E). A majority of the mulberries recorded in Georgia were in good condition (81%), 19% were in bad condition (Figure GE_1F).
Figure GE_1G shows the pruning practices of the mulberries recorded in Georgia. Seventy-two percent of the recorded mulberries were unpruned, 26% were frequently pruned and only 2% were yearly pruned. About half (48%) of the recorded mulberries featured a greyish brown, half (47%) a light brownish grey and only a few (5%) a dark brown (reddish-brown) trunk colour (Figure GE_1H).



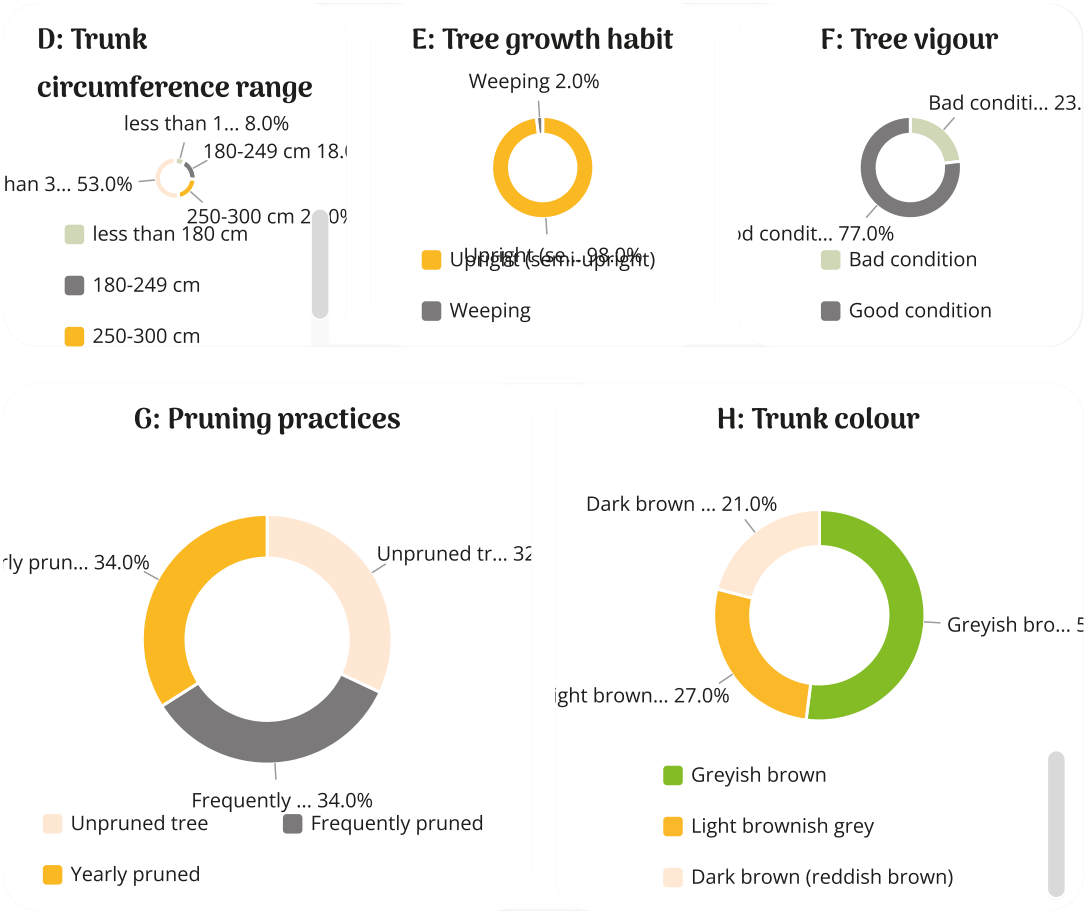
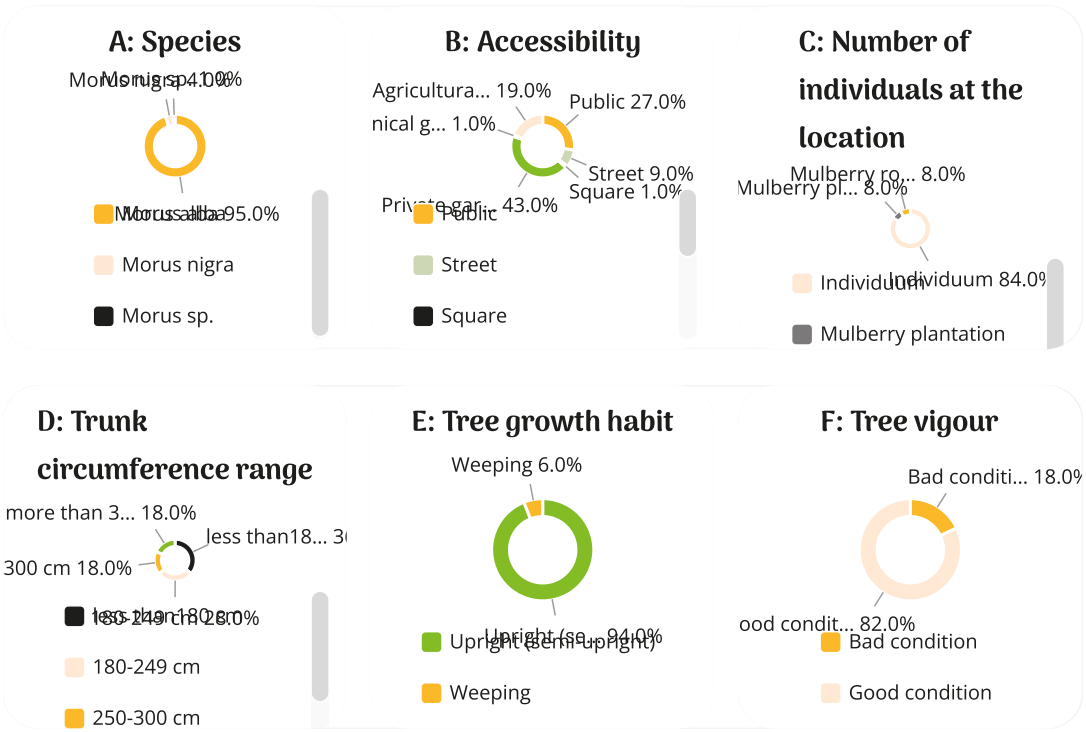


Figure IT_ 1 - Basic information on the inventory of mulberry trees in Italy. A) Percentage of recorded *M. alba* and *M. nigra* trees **N=378**). B) Accessibility options of trees (**N=374**). C) State on the number of individuals at location (**N=378**). D) Percentage of trees at certain trunk circumference range (**N=361**). E) Percentage of trees of upright and weeping growth habit (**N=279**). F) Percentage of trees in bad and good condition (**N=325**). G) Report on the pruning frequency of the trees (**N=378**). H) The percentage of trees of different trunk colours (**N=171**).



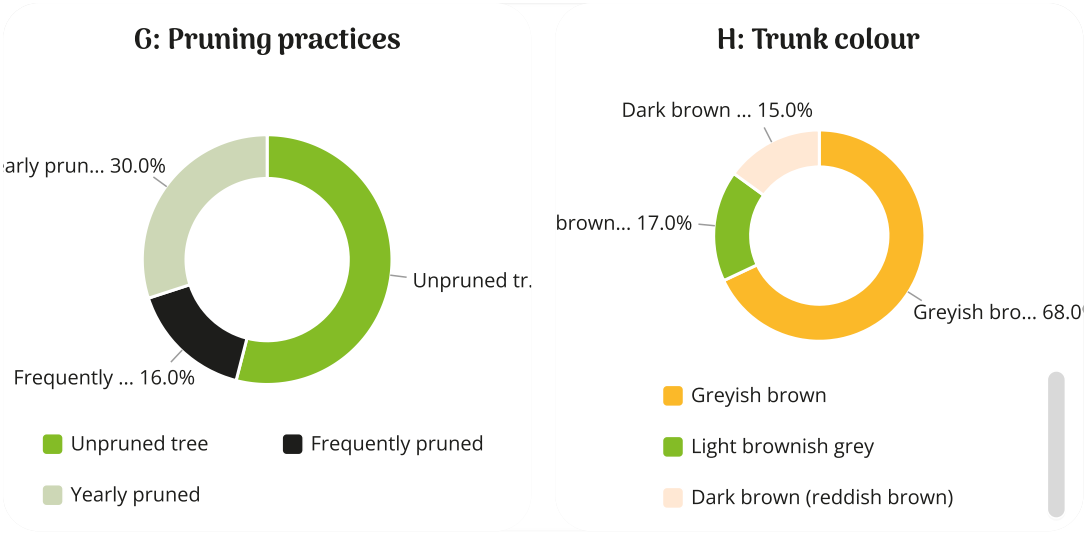
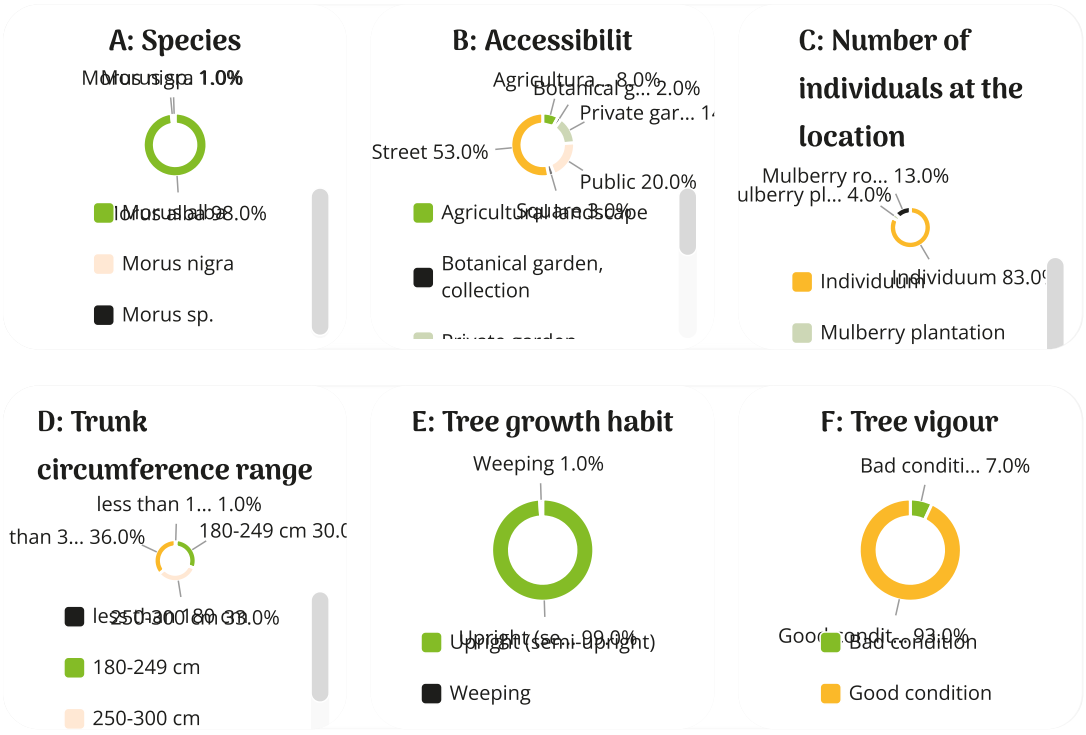


Figure SI_1 - Basic information on the inventory of mulberry trees in Slovenia. A) Percentage of recorded *M. alba* and *M. nigra* trees. B) Accessibility options of trees. C) State on the number of individuals at location. D) Percentage of trees at certain trunk circumference range. E) Percentage of trees of upright and weeping growth habit. F) Percentage of trees in bad and good condition. G) Report on the pruning frequency of the trees. H) The percentage of trees of different trunk colours.



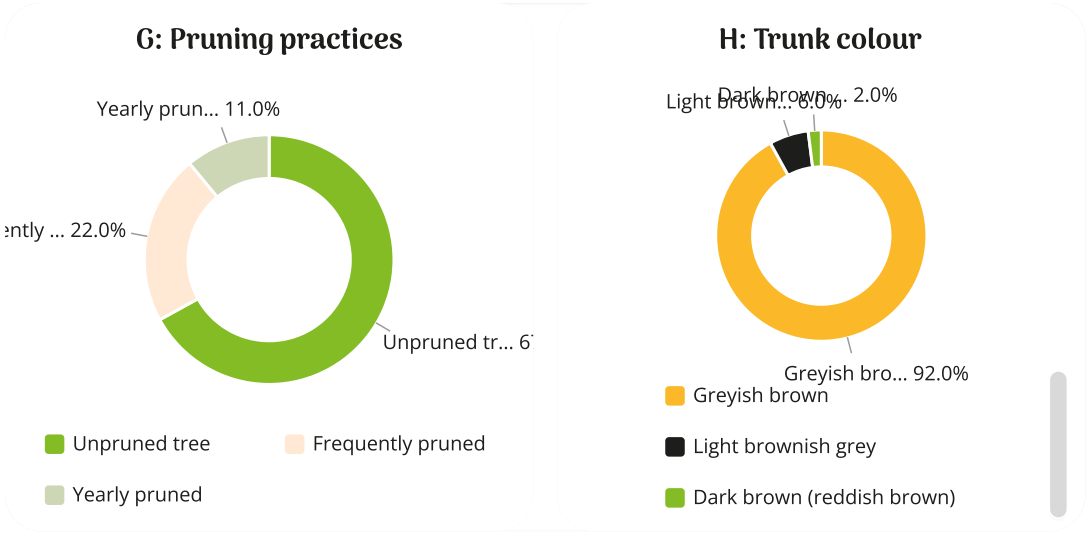
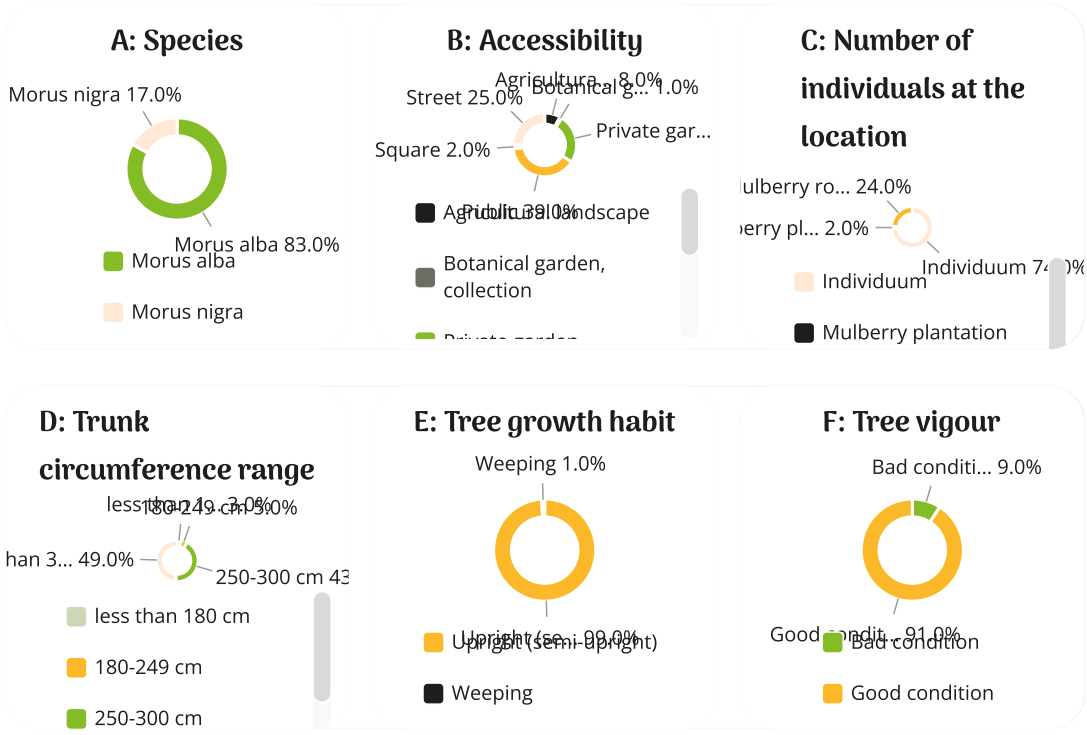


Figure BG_ 1 - Basic information on the inventory of mulberry trees in Bulgaria (N=180). A) Percentage of recorded *M. alba* and *M. nigra* trees. B) Accessibility options of trees. C) State on the number of individuals at location. D) Percentage of trees at certain trunk circumference range. E) Percentage of trees of upright and weeping growth habit. F) Percentage of trees in bad and good condition. G) Report on the pruning frequency of the trees. H) The percentage of trees of different trunk colours.



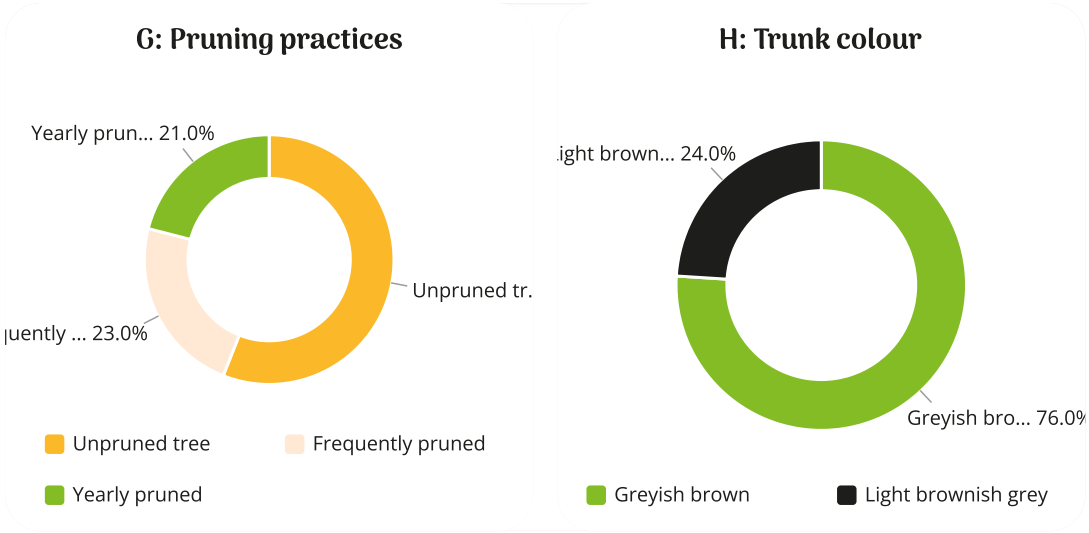
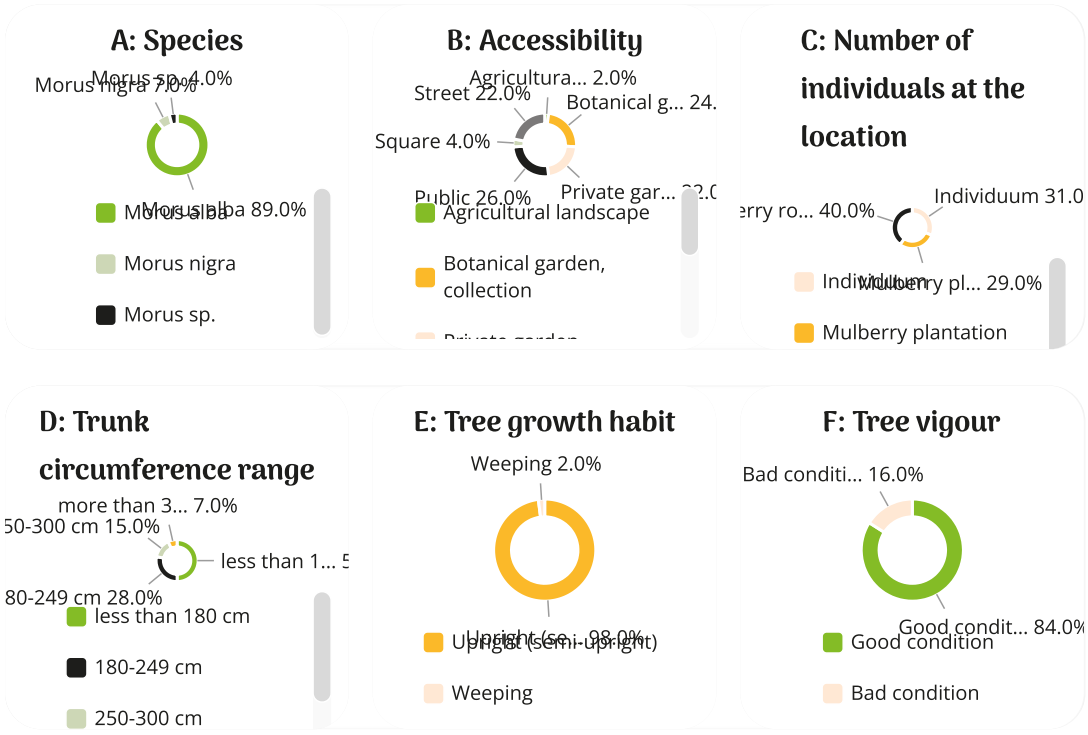


Figure ES_1 - Basic information on the inventory of mulberry trees in Spain (N=102). A) Percentage of recorded *M.alba and M. nigra* trees. B) Accessibility options of trees. C) State on the number of individuals at location. D) Percentage of trees at certain trunk circumference range. E) Percentage of trees of upright and weeping growth habit. F) Percentage of trees in bad and good condition. G) Report on the pruning frequency of the trees. H) The percentage of trees of different trunk colours.



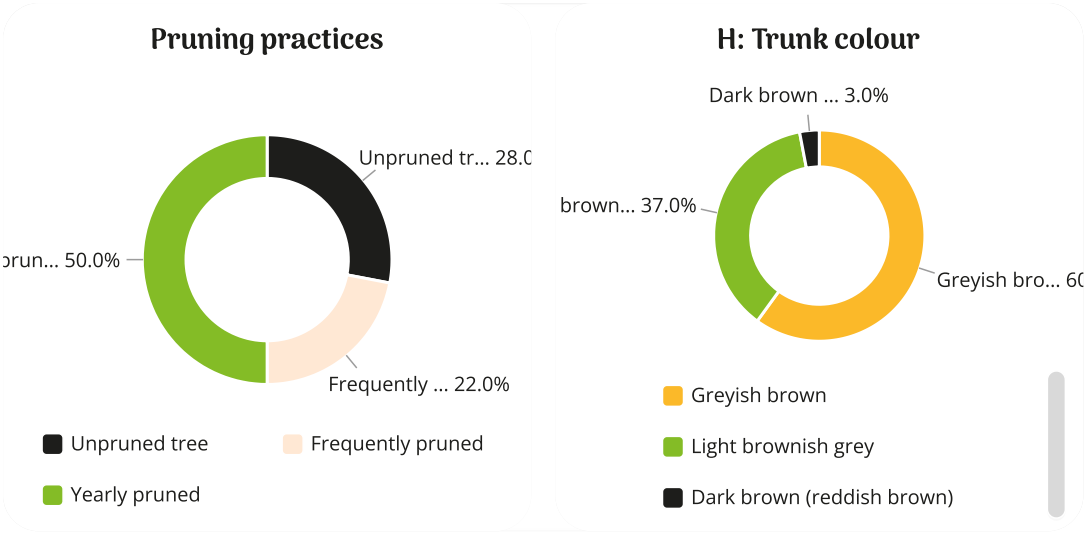
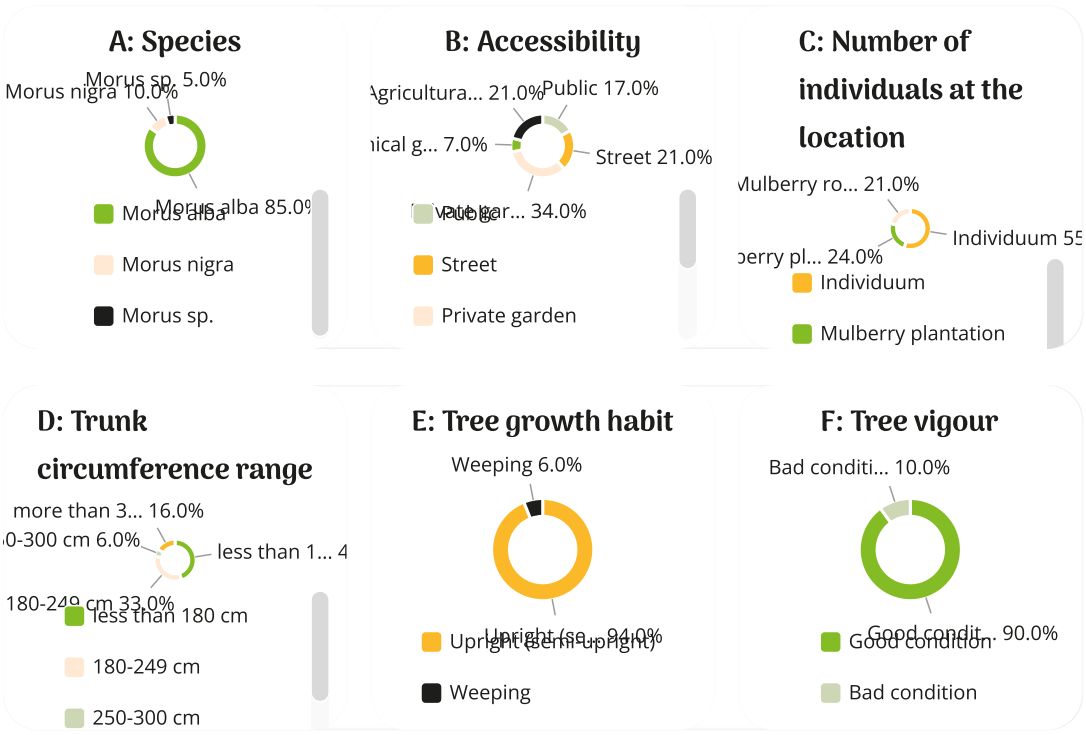


Figure FR_1 - Basic information on the inventory of mulberry trees in France. A) Percentage of recorded *M. alba* trees. B) Accessibility options of trees. C) State on the number of individuals at location. D) Percentage of trees at certain trunk circumference range. E) Percentage of trees of upright and weeping growth habit. F) Percentage of trees in bad and good condition. G) Report on the pruning frequency of the trees. H) The percentage of trees of different trunk colours.



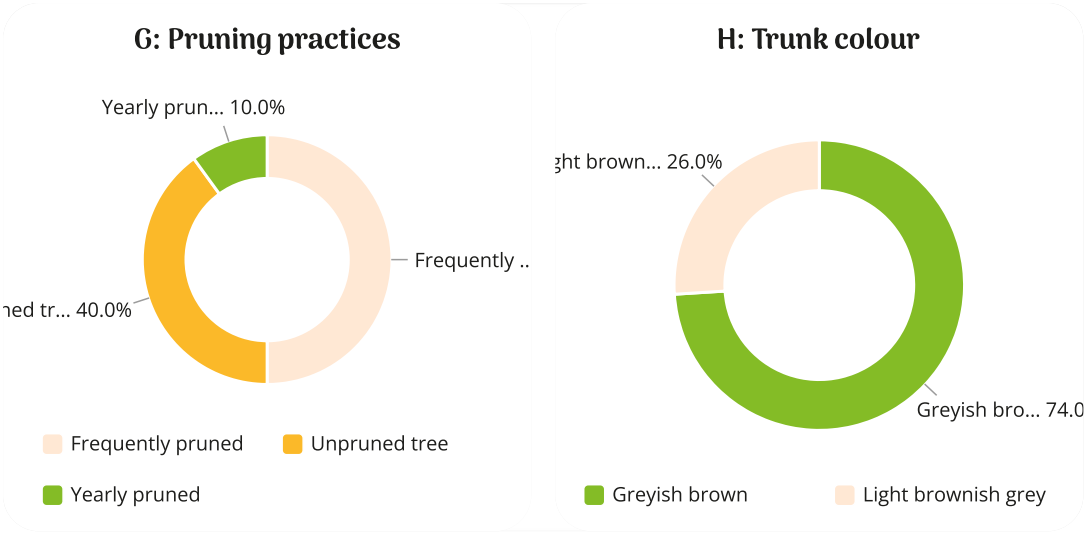
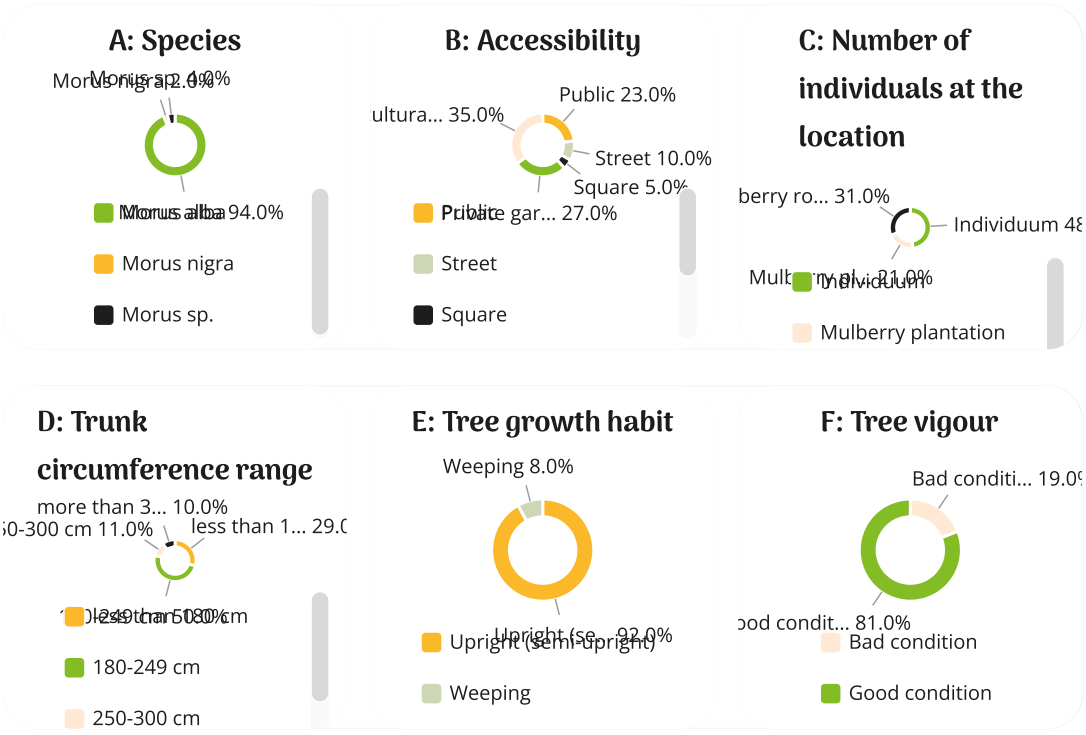


Figure GR_ 1- Basic information on the inventory of mulberry trees in Greece. A) Percentage of recorded *M. alba and M. nigra* trees. B) Accessibility options of trees. C) State on the number of individuals at location. D) Percentage of trees at certain trunk circumference range. E) Percentage of trees of upright and weeping growth habit. F) Percentage of trees in bad and good condition. G) Report on the pruning frequency of the trees. H) The percentage of trees of different trunk colours.



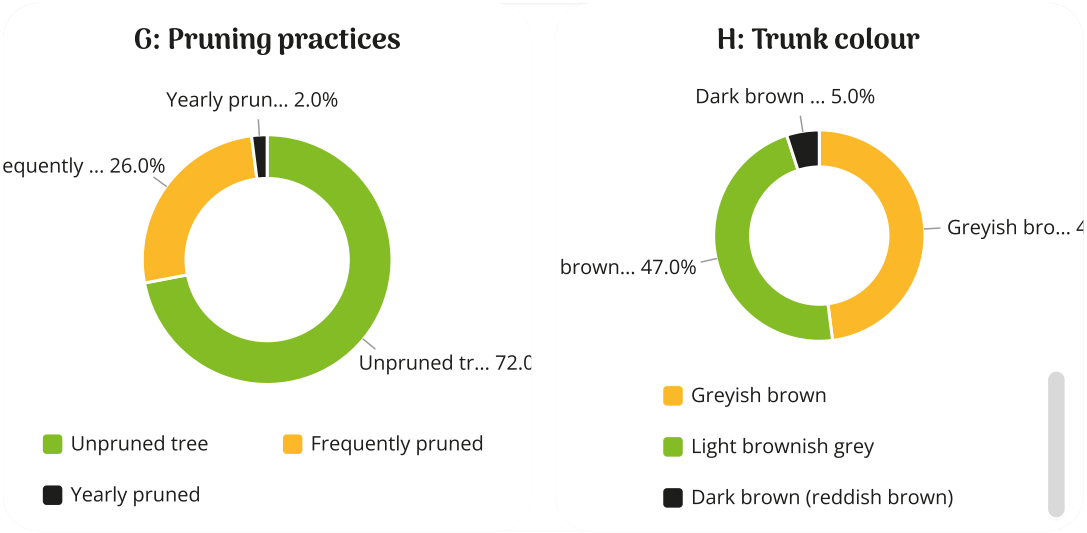


Figure GE_1 - Basic information on the inventory of mulberry trees in Georgia. A) Percentage of recorded *M. alba* and *M. nigra* trees (N=81). B) Accessibility options of trees (N=81). C) State on the number of individuals at location (N=81). D) Percentage of trees at certain trunk circumference range (N=81). E) Percentage of trees of upright and weeping growth habit (N=78). F) Percentage of trees in bad and good condition (N=72). G) Report on the pruning frequency of the trees (N=81). H) The percentage of trees of different trunk colours (N=75).

Inventory of black mulberry trees

The inventory of black mulberries (*Morus nigra*) by origin indicates that the majority of the 59 trees was in Spain (17 trees), Slovenia (15 trees), Croatia (13 trees), France (3 trees), Greece (3 trees), Bulgaria (2 trees), Italy (2 trees), United Kingdom (2 trees), and Georgia (2 trees) (Figure general_ 2B, Figure general_ 8).

The majority of recorded black mulberries (41%) were found in private gardens, followed by those in public areas (20%), agricultural areas (15%), along streets (14%), in botanical gardens or collections (8%), and in squares (2%). All recorded black mulberry trees grew individually (Figure general_ 9A).

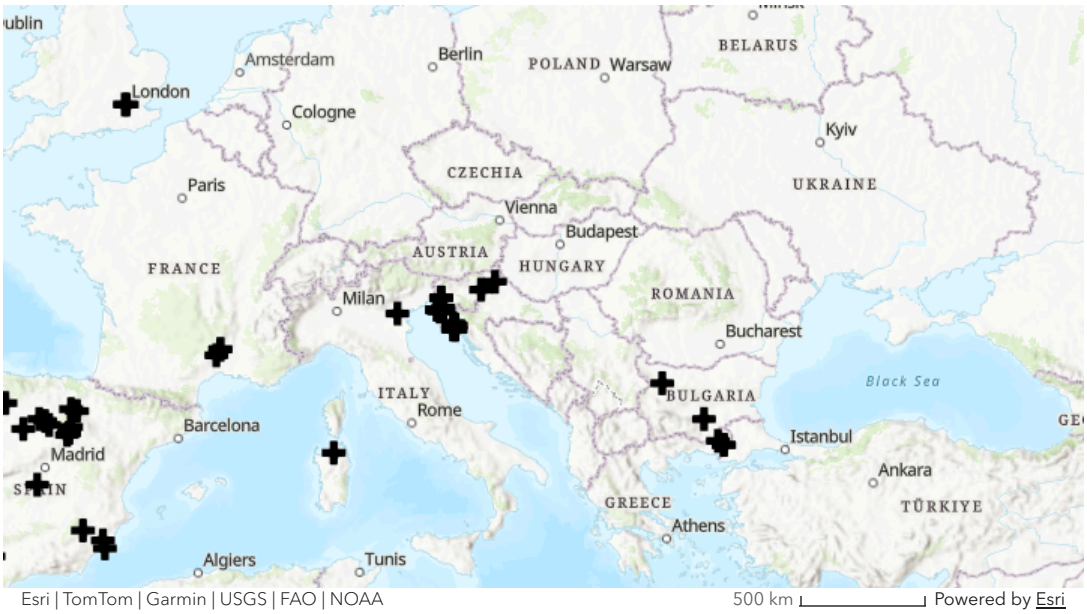
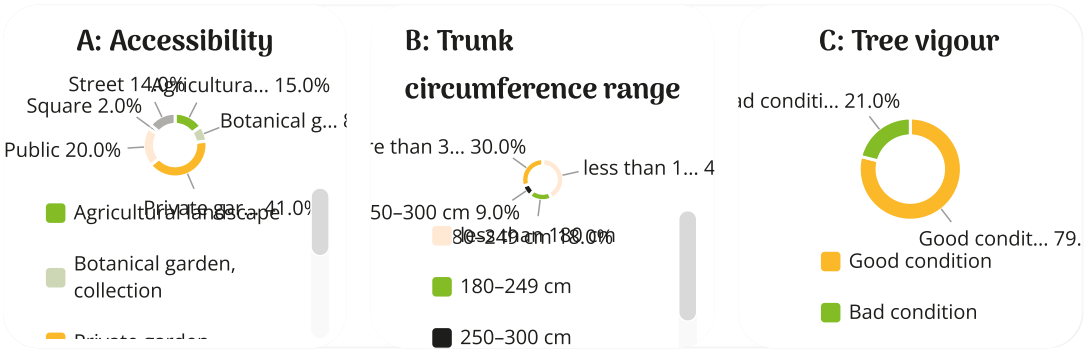


Figure general_ 5 - Distribution map of black mulberry trees using *Morus* APP.

The distribution of black mulberries based on trunk circumference shows that the largest proportion (43%) had a circumference below 180 cm, while 30% had a very large circumference of more than 300 cm. Trees with a circumference of 180–249 cm accounted for 18%, while those with a circumference of 250–300 cm made up 9% (Figure general_ 6B). Assessing tree vigour, we found that 79% of the trees were in good condition, whereas 21% were in bad condition (Figure general_ 6C). The majority of trees (81%) were unpruned, while 7% were yearly pruned, and 12% were frequently pruned (Figure general_ 6D).

The predominant trunk colour was greyish brown (60%), while 28% of the trees had a light brownish-grey colour, and 12% had a dark brown trunk (Figure general_6E).

Trunk irregularities were observed in 16 trees. Among these, 40% had curved trunks, 27% were split, 20% exhibited longitudinal cracks and 13% were hollow (Figure general_ 9F).



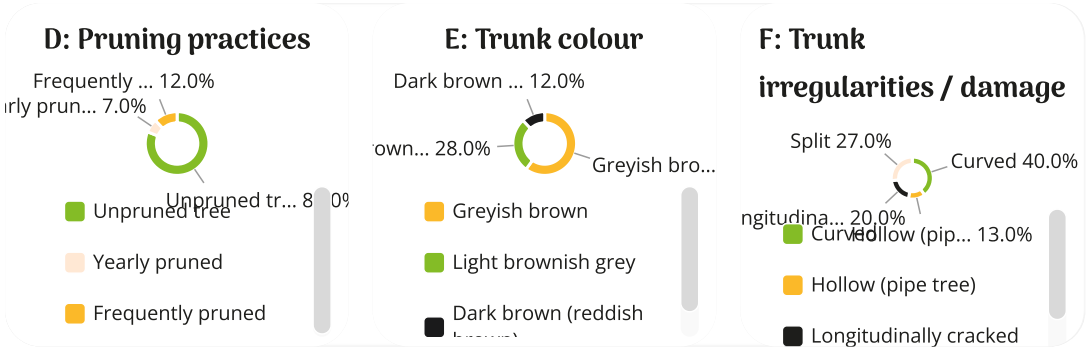


Figure general_ 6: Basic information on the recorded black mulberry trees from all countries (Austria, Bulgaria, Croatia, France, Georgia, Greece, Italy, Spain, Slovenia, United Kingdom). A) Accessibility options of trees (N=59). B) Percentage of trees within defined trunk circumference range (N=56). C) Percentage of trees in bad and good condition (N=53). D) Report on the pruning frequency of the trees (N=59). E) Percentage of trees of different trunk colours (N=26). F) Percentage of trees with defined trunk irregularities (N=16).

Imprint

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Short name
CREA
UM
SCS
NKUA
IMIDA
SSM
ASSOIE

Morus APP national administrators outside the project consortium and editors, anonymous
Morus APP: https://morusapp.aracneproject.eu/
Morus APP manual (hyperlink): Morus App manual: https://www.fkbv.um.si/wp-content/uploads/2023/06/ARACNE_Morus-APP_Mulberry-specification-guide-and-manual.pdf

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