Identification Handbook

for

non native tree species in the Alpine Space

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Alpine Space
ALPTREES
European Regional Development Fund
EUROPEAN UNION

This little companion is intended to help you to identify non-native tree species. It would like to be part of your family and circle of friends. We hope the booklet will call out to you from within your backpack or trouser pockets to reveal the interesting world of non-native tree species.

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DEAR READER

Dear Reader,

Non-native trees are sometimes also referred to as “aliens” or as “introduced” or “exotic” trees. Those are tree species growing outside their native range or ecotype. Trees are classified as “native” only if they grow within an area in which they traditionally occurred prior to the introduction – wether intentional or unintentional.

Climate change and human activity represent major threats to the ecosystems in the Alpine space. Adaptation efforts are therefore required to respond to negative effects on the Alpine environment, economy, and society. Originating in environments with warmer and dryer conditions, non-native tree species can support the adaptation of European forests and urban areas to climate change.

The expected benefits and potential risks of the use of non-native trees for the regions of the Alpine space have polarized the opinions of experts and citizens. Benefits include adaptation to climate change, contributions to bioeconomy, urban and peri-urban green infrastructure, and mitigation of natural hazards, while risks include invasiveness by non-native tree species and their effects on native biodiversity.

The distinction between non-native and native is important because some non-native tree species are considered invasive and can alter the ecosystem of the area they grow in. Observing nature and being able to identify potentially invasive species can help to better evaluate the dissemination of non-native species and their invasiveness in forests and cities.

The Interreg-funded ALPTREES project is dedicated to investigating the opportunities and risks that non-native tree species provide for the future of our urban und forest areas as well as developing guidelines for their use and management within the Alpine space.

All information provided in this compendium represents the state of scientific knowledge in June 2021.

We hope you have fun with this booklet and take it along whenever you stroll, hike, climb, and enjoy nature!

The ALPTREES Team

HOW TO USE THIS GUIDE?

In this pocket guide, we describe 49 non-native tree species (NNT) selected from more than 530 NNT that occur in forests, peri-urban and urban areas in the Alpine Space. We selected these NNT because they are widely distributed in the countries of the Alpine Space (i.e. Austria, Italy, Slovenia, France, Switzerland and Germany) and appear useful for climate change adaptation due to their species-specific characteristics. Some of these species were selected because they may have the potential to be or become colonising character. Each tree species is presented on four pages with a brief general description, a drawing, and photographs of the characteristic and morphological species features. In addition, various symbols and icons are used throughout the brochure for each species to represent their potential invasiveness, ecological requirements, and degree of allergic potential.

The symbols for invasive potential of tree species were created based on published literature and our expert opinions. The invasiveness category is not the result of a risk assessment, but rather should be understood as an indication that the species may have potential negative impacts on biodiversity, socio-economy, or other aspects and therefore further investigation and risk assessment may be required. The symbols for NNT occurring in urban or/and forest areas were created according to the results of the ALPTREES project based on the tree species database. The values of tree species regarding shade, drought and waterlogging tolerance are based on the publication of Niinemets and Valladares (2006). The values regarding frost tolerance are based on literature and were prepared for each tree species; the references are not listed here due to the long literature list. Allergy potential icons were created according to https://www.pollenlibrary.com/.

References: Niinemets, Ü., Valladares, F. 2006. Tolerance to shade, drought, and waterlogging of temperate Northern Hemisphere trees and shrubs. Ecological Monographs 76:521–547.

LEGEND

NNT not (yet) considered invasive in the Alpine Space

NNT considered (potentially) invasive in open forests

Use of the NNT is prohibited within the EU as it has been declared an invasive non-native species of Union Concern according to Regulation (EU) No. 1143/2014

Tree species occurs in urban and forested areas

Tree species occurs only in urban areas

Tree species occurs only in forested areas

LEGEND

DROUGHT TOLERANCE:
Scale from 0 (no tolerance) to 5 (very high tolerance) highlighted symbols.

FROST TOLERANCE:
Scale from 0 (no tolerance) to 5 (very high tolerance) highlighted symbols.

SHADE TOLERANCE:
Scale from 0 (no tolerance) to 5 (very high tolerance) highlighted symbols.

WATERLOGGING TOLERANCE:
Scale from 0 (no tolerance) to 5 (very high tolerance) highlighted symbols.

ALLERGIC POTENTIAL:
Scale from 0 (no allergic potential) to 3 (high allergic potential) highlighted symbols.

Abies bornmuelleriana (Mattf.)

Bornmüller's fir

01

Abete turco

Sapin de Turquie

Bornmüller-Tanne, Türkische Tanne

Bornmüllerjeva jelka, turška jelka

01 *Abies bornmuelleriana* (Mattf.)

Bornmüller's fir

Abies bornmuelleriana (Mattf.)

Bornmüller's fir

01

ORIGIN: Mountains of north-western Turkey

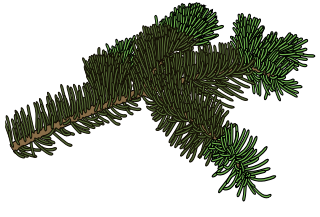
INTRODUCED TO EUROPE: 19th century

OCCURRENCE IN THE ALPINE SPACE: Used along roads in Italy; several trial plots in Germany, Austria, and Switzerland

MAIN CHARACTERISTICS: A fast-growing coniferous tree with a straight trunk. Grows up to 60 m high and up to 1 m in diameter. Its **bark** is reddish-grey and smooth in youth and becomes rough with age. The **needles** are mainly parted, 25 to 38 mm long and 1.2-2 mm wide. They are pointed on fertile branches and round or edged elsewhere. The dark red female **flowers** grow up to 1 cm long. The **cones** are cylindrical, up to 15 cm long and up to 6.5 cm wide, with short stalks. The deck scales project far outward and are bent backwards. **Seeds** are 8-9 mm long, about 5 mm wide, and carry 10 mm long wings.

ECOLOGY: A mixed forest species of the montane and subalpine forests. Different geology types exist in its native range (slate, serpentine, andesite, sandstone, flysch, marl slate and carbonate, deep, sandy loam soils). It prefers nutrient-rich sites and avoids groundwater-influenced soils. Occupying a similar position in the forest community as the Nordmann fir (*Abies nordmanniana*), it dominates its natural habitat due to its tolerance to shade. Especially in the late stages of ecological succession, it copes very well with drought but does not tolerate waterlogging.

SIMILAR TREES: *Abies nordmanniana*



01 *Abies bornmuelleriana* (Mattf.)

Bornmüller's fir

Invasiveness

Not considered invasive

Occurrence

Drought tolerance (*)

Frost tolerance

Shade tolerance (*)

Waterlogging tolerance (*)

Allergic potential (*)

(*) Data not available for this species

Abies cephalonica Loudon

02

Greek fir, Grecian fir

Abete di Cefalonia,
Abete greco

Sapin de Grèce,
Sapin de Céphalonie

Griechische Tanne

Grška jelka

02 *Abies cephalonica* Loudon

Greek fir, Grecian fir

Abies cephalonica Loudon

Greek fir, Grecian fir

02

ORIGIN: Greek islands, Euboea in the Aegean Sea and Cephalonia in the Ionian Sea

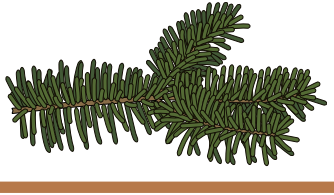
INTRODUCED TO EUROPE: 1824, Great Britain

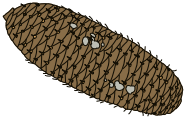
OCCURRENCE IN THE ALPINE SPACE: Warm and dry habitats in the Mediterranean area, parks and gardens

MAIN CHARACTERISTICS: A coniferous tree with a wide, branched, conical crown, grows up to 30 m in height. The **bark** is smooth in youth, while older trees have grey-brown and longitudinally cracked bark. **Needles** are 15-30 mm long, 20-25 mm wide, and mostly distributed around shoots. They are flat, sharply pointed, and barbed; on higher branches, they are curved and shorter with blunt edges. Male **flowers** are purple-red and 18 mm long, while female **flowers** form green inflorescences. The **cones** are upright, 10-16 cm long, 2.5-4.5 cm thick, brown, and resinous. The tree does not create a soil or canopy **seed** bank like other relict *Abies* spp. Its deck scales are bent backwards and visible underneath the fertile scales.

ECOLOGY: Optimal conditions for the Greek fir are well-drained and calcareous soils. In the northern part of its natural range, it also grows on slightly acidic siliceous soil. The climate of its native range has relatively dry summers and wet winters, with annual precipitation between 700 and 1,500 mm. It is a late succession, shade-preferring species and belongs to a group within the genus *Abies* that presents the earliest bud burst and the shortest elongation period. It occupies geographical zones with mean annual temperature ranges of 7.5-16°C but does not tolerate temperatures below -15°C. It is vulnerable to fire, as it neither produces serotinous **cones** nor maintains a canopy seed bank when summer wildfires occur.

SIMILAR TREES: *Abies borisii-regis, Abies pinsapo*





02 *Abies cephalonica* Loudon

Greek fir, Grecian fir

Invasiveness

Not considered invasive

Occurrence

Drought tolerance (*)

Frost tolerance

Shade tolerance (*)

Waterlogging tolerance (*)

Allergic potential (*)

(*) Data not available for this species

Abies grandis (Douglas ex D. Don) Lindley

Grand fir

03

Abete bianco americano

Sapin de Vancouver, Sapin Géant

Küstentanne, Riesentanne

Velika jelka

03 *Abies grandis* (Douglas ex D. Don) Lindley

Grand fir

Abies grandis (Douglas ex D. Don) Lindley

Grand fir

03

ORIGIN: Western part of USA

INTRODUCED TO EUROPE: 1830

OCCURRENCE IN THE ALPINE SPACE: Forest plantations, parks, and gardens

MAIN CHARACTERISTICS: A coniferous tree growing up to 60 m in height and up to 1.3 m in diameter. The **bark** on older trees is red-brown and deeply cracked. Its **needles** are 3-6 cm long, 2-2.5 mm wide, flat, dark green, and shiny on top with two white stripes at the bottom. Male **flowers** are small and scarlet, while the female inflorescence is yellow-green. The **cones** are upright, 5-10 cm long, and resinous. Its deck scales are short and not visible in a closed cone.

ECOLOGY: The Grand fir grows at altitudes up to 1,500 m on fresh, deep, and rich soils, but is less demanding in this regard than the native *Abies alba*. It is more resistant to cold, disease, and pests than Abies alba, but does not tolerate drought or air pollution. It is very shade tolerant, especially when young, although growth is slower in shade.

SIMILAR TREES: *Abies procera*, other species from genera *Abies* spp.

03 *Abies grandis* (Douglas ex D. Don) Lindley

Grand fir

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Abies nordmanniana (Steven) Spach

Nordmann fir/Caucasion fir

04

Abete di Nordmann,
Abete del Caucaso

Sapin de Nordmann,
du Caucase, de Crimée

Nordmann-Tanne

Kavkaška jelka

04 *Abies nordmanniana* (Steven) Spach

Nordmann fir, Caucasion fir

Abies nordmanniana (Steven) Spach

Nordmann fir, Caucasion fir

04

ORIGIN: Western Caucasus and south-eastern Anatolia

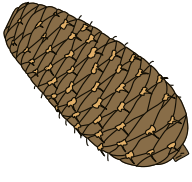
INTRODUCED TO EUROPE: 19th century

OCCURRENCE IN THE ALPINE SPACE: Parks, Christmas tree plantations, experimental plots

MAIN CHARACTERISTICS: A strong and straight coniferous tree species with a dense, conically shaped crown. It reaches up to 50 m in height and 1.5 m in diameter. The **bark** is grey to grey-brown with longitudinal fissures. In the upper part of the crown, the **needles** are shorter (1-2 cm), pointed, and spirally arranged, while in the lower area they grow slightly longer (2-3 cm), have a blunt or angular tip, and are arranged in two lines. Two stomata bands can be found on the light green lower surface; the upper surface is dark green. The upright, light green to reddish female **flowers** are located at the top of the crown; male **flowers** are reddish-yellow and oblong to ovate. The **cones** are brown, egg-shaped or elongated, erect, and narrow at the base and tip, 8-16 cm long and 3-5 cm wide. The **seeds** grow up to 6-10 mm long and 5-8 mm wide and have thin purple or brown wings with a leathery skin.

ECOLOGY: The Nordmann fir is a semi-shady to shady tree species that thrives best in humus-rich, nutrient-rich, and deep soils at altitudes of 1,000-1,800 m. Its native range features annual rainfall of 800 to 2,400 mm and an average annual temperature of 6-11°C, with temperatures not lower than -25°C. It is sensitive to heat and drought when young, but this sensitivity lessens from the age of 2-3 years, and it grows well in dry locations. A highly competitive species.

SIMILAR TREES: *Abies bornmulleriana*, *Abies equi-trojani*, other species from genera *Abies* spp.



04 *Abies nordmanniana* (Steven) Spach

Nordmann fir, Caucasion fir

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Acer negundo L.

Box elder, Ash-leaved maple

05

Acero americano, acero negundo

Erable Negundo

Eschen-Ahorn

Ameriški javor, negundovec

05

Acer negundo L.

Box elder, Ash-leaved maple

Acer negundo L.

Box elder, Ash-leaved maple

05

ORIGIN: North America

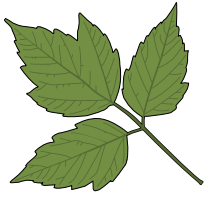
INTRODUCED TO EUROPE: 1688

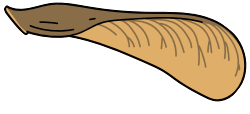
OCCURRENCE IN THE ALPINE SPACE: Natural and urban riparian forest ecosystems

MAIN CHARACTERISTICS: A deciduous, medium-sized tree that usually grows upright. In the shade of other trees, it sometimes bends or trails. The box elder grows up to 20 m high with grey or light brown **bark** that is smooth in youth and begins to crack with age. Its **leaves** are opposite, pinnately compound with 3 to 5 (sometimes 7) widely lanceolate to ovate leaflets with a short petiole. The terminal leaflet is often three-lobed. Leaflets are light green above and paler below. The **flowers** are yellow-green with long stalks and grow in hanging clusters, as do the **fruits** in the form of paired V-shaped samaras.

ECOLOGY: Optimal growth conditions exist on moist, sandy, well-permeable alluvial soils. The box elder tolerates low winter temperatures, though wind and snow are unsuitable. It can have a competitive advantage over native species thanks to its high shade tolerance and high growth in full light. It is also able to outcompete native vegetation by forming dense populations and via allelopathic effects. Water availability is supposedly the most determining factor for its survival.

SIMILAR TREES: *Acer cissifolium, Acer maximowiczianum*





05

Acer negundo L.

Box elder, Ash-leaved maple

Invasiveness

(potentially) invasive open riparian and alluvial forest

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Acer saccharinum L.

Silver maple, Creek maple, Silverleaf maple

06

Acero saccarino, acero argenteo, acero bianco

Erable argenté

Silber-Ahorn

Srebrni javor

06

Acer saccharinum L.

Silver maple, Creek maple, Silverleaf maple

Acer saccharinum L.

Silver maple, Creek maple, Silverleaf maple

06

ORIGIN: Eastern and Midwestern United States

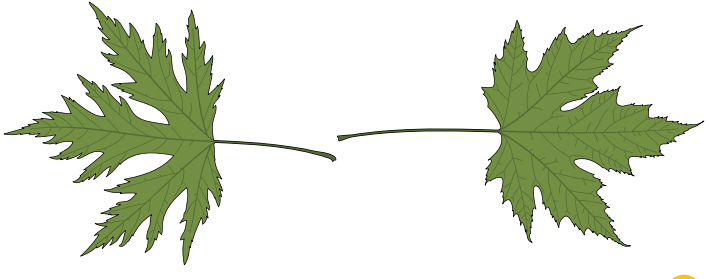
INTRODUCED TO EUROPE: 1725

OCCURRENCE IN THE ALPINE SPACE: Parks, avenues, riparian habitats

MAIN CHARACTERISTICS: A deciduous, medium-sized tree with a regular, bright, elongated and highly rounded crown and distinct trunk. It grows up to 40 m in height, with grey or light brown **bark** that stays smooth for a long time before cracking in older trees and becoming plated. The **leaves** are opposite and decussate, palmately divided or palmately patched, 9-10 cm wide and 6-11 cm long. They are dark green and naked above, with silver-grey to white undersides. The inflorescence is a red or green-yellow corymb without petals; the **fruits** are samaras.

ECOLOGY: The silver maple prefers moist, deep, and well-drained soil but can tolerate occasional floods, pollution, and drought. It is resistant to low temperatures, but sensitive to strong wind and heavy snow.

SIMILAR TREES: *Acer rubrum*



06

Acer saccharinum L.

Silver maple, Creek maple, Silverleaf maple

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Acer tataricum L.

07

Tatarian maple

Acero tataro

Erable de Tartarie

Tatarischer Ahorn

Tatarski javor

07

Acer tataricum L.

Tatarian maple

Acer tataricum L.

Tatarian maple

07

ORIGIN: Eastern Europe and Western Asia

INTRODUCED TO EUROPE: Native to Eastern Europe

OCCURRENCE IN THE ALPINE SPACE: Parks, gardens

MAIN CHARACTERISTICS: A deciduous tree with slender branches that often grows as a bush. The Tatarian maple has a maximum height of up to 12 m and a maximum diameter of 90 cm. Its **bark** is grey or light brown and smooth in youth; it becomes darker and cracks longitudinally with age. The simple **leaves** are opposite and decussate, oblong-ovate with a doubly serrate edge and some hair on the veins on their underside. The inflorescence is a white panicle without petals; the fruit is a samara.

ECOLOGY: Grows optimally on fresh to moist, deep soil rich in nutrients, on limestone soils, alluvium and even dry rocks. It can grow in continental climate and withstand temperatures down to -25°C as well as long droughts, but is only moderately shade-tolerant. This pioneer species can grow intensively on bare surfaces.

SIMILAR TREES: *Acer monspessulanum, Acer negundo, Hamamelis* sp.

07

Acer tataricum L.

Tatarian maple

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Aesculus x *carnea* Zeyh.

Red horse-chestnut

08

Ippocastano rosso

Marronnier à fleurs rouges

Fleischrote Ross-Kastanie

Rožnati divji kostanj

08 *Aesculus x carnea* Zeyh.

Red horse-chestnut

Aesculus x carnea Zeyh.

Red horse-chestnut

08

ORIGIN: Unknown, assumed to be Germany around 1818

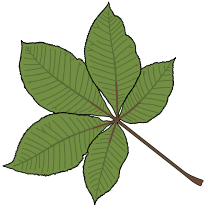
INTRODUCED TO EUROPE: Around 1818

OCCURRENCE IN THE ALPINE SPACE: Parks, avenues, gardens

MAIN CHARACTERISTICS: A tree that grows 6 to 12 m (rarely up to 20 m) tall, which is small compared to other types of horse-chestnuts. The **bark** is smooth for a long time and starts cracking with age. It has dark green palmate compound **leaves** with 5 (sometimes 7) spreading ovate-oblong leaflets (15-25 cm long) with doubly toothed margins. The leaflets are dark, wrinkled, slightly shiny, and jagged, with a short petiole. The **flowers** are pink to red and form 12-20 cm long panicle inflorescences. The tree has a prickly **seed** pod containing 2 to 3 glossy brown nuts, which are poisonous.

ECOLOGY: Optimal growing conditions are deep, nutrient-rich, airy, fresh to moist sandy-loamy soils. It likes sun exposure and warm sites and does not tolerate shade well. The red horse-chestnut can grow in low temperatures, but frost is harmful for **seed**lings on moist grounds. This species withstands polluted air and drought better than *Aesculus hippocastanum*.

SIMILAR TREES: *Aesculus hippocastanum, Aesculus pavia, Aesculus parviflora*



08 *Aesculus x carnea* Zeyh.

Red horse-chestnut

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Ailanthus altissima (Mill.) Swingle

09

Tree of heaven

Albero del paradiso, Ailanto

Faux vernis du Japon ou Ailante

Götterbaum

Visoki pajesen

09 *Ailanthus altissima* (Mill.) Swingle

Tree of heaven

Ailanthus altissima (Mill.) Swingle

Tree of heaven

09

ORIGIN: East Asia

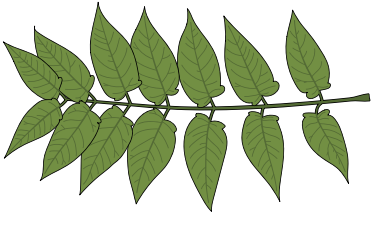
INTRODUCED TO EUROPE: 1751

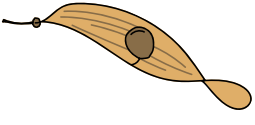
OCCURRENCE IN THE ALPINE SPACE: Riparian forests, mesic and xeric woodlands, abandoned sites in urban and agricultural areas, along train tracks and roads

MAIN CHARACTERISTICS: A deciduous tree with a sparse, rounded crown and flat, strong trunk that grows up to 25 m in height. Its **bark** is thin and moderately smooth with white longitudinal cracks. The **leaves** are dark green above and light green below. They are arranged in a spiral 30-90 cm long made up of 11-25 leaflets that are wide, stalked, and oblong-elliptic. The pale yellow **flowers** are joined in panicle inflorescences. The **fruits** are 3-4 cm long samara that are a light reddish brown and grow in clusters.

ECOLOGY: Optimal growing conditions are deep and fresh soils. It can also grow on moderately rocky or sandy soils and tolerates long-term drought and city pollution, but avoids humid and compact soils. Young plants are sensitive to extreme cold, while older plants tolerate temperatures down to -30°C. The tree is known as a heliophyte and likes warm climates.

SIMILAR TREES: *Pterocarya fraxinifolia, Rhus typhina, Fraxinus excelsior*





09 *Ailanthus altissima* (Mill.) Swingle

Tree of heaven

Invasiveness

(potentially) invasive in open areas; invasive species of European Union Concern (EU Reg. No. 1143/2014)

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Alnus cordata (Loisel.)

Italian alder

10

Ontano napoletano

Aulne à feuilles en cœur

Herzblättrige Erle

Srčastolistna jelša

10 *Alnus cordata* (Loisel.)

Italian alder

Alnus cordata (Loisel.)

Italian alder

10

ORIGIN: Southern Apennine Mountains and the north-eastern mountains of Corsica

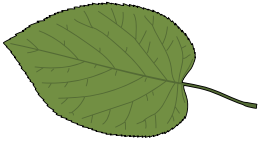
INTRODUCED TO EUROPE: Unknown

OCCURRENCE IN THE ALPINE SPACE: Parks, gardens

MAIN CHARACTERISTICS: A deciduous tree with a smallish, dense, broadly conical or columnar crown. It sometimes grows with multiple stems or as a shrub, and often has a crooked trunk. The Italian alder grows up to 20 m in height and has a grey and long-lived **bark**. The **leaves** are arranged in a spiral; they are simple, egg-shaped or oval, 4-10 cm long and 3-7 cm wide, and doubly serrate. The **flowers** are joined in catkins, with male catkins up to 9 cm long, yellow, and hanging, while females are short-stalked and red. The fruit is green, with a woody oval structure known as a strobile that resembles a conifer cone.

ECOLOGY: This species grows well on moist, well-drained soil, but is also tolerant of dry and poor conditions. It is resistant to wind.

SIMILAR TREES: *Alnus incana*



10 *Alnus cordata* (Loisel.)

Italian alder

Invasiveness

Not considered invasive

Occurrence

Drought tolerance (*)

Frost tolerance

Shade tolerance (*)

Waterlogging tolerance (*)

Allergic potential

(*) Data not available for this species

Broussonetia papyrifera Vent.

Paper mulberry

11

Gelso da carta

Mûrier de Chine ou mûrier à papier

Papier-Maulbeerbaum, Japan. Papierbaum

Navadna papirjevka

11 *Broussonetia papyrifera* Vent.

Paper mulberry

Broussonetia papyrifera Vent.

Paper mulberry

11

ORIGIN: East Asia

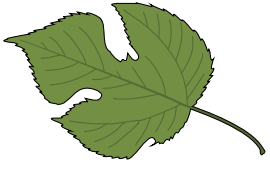
INTRODUCED TO EUROPE: 1900

OCCURRENCE IN THE ALPINE SPACE: Parks, gardens, hedges

MAIN CHARACTERISTICS: A small to medium-sized deciduous tree with a regular, rounded crown. It grows up to 35 m in height and 70 cm in diameter. The **bark** is grey to light brown, smooth in younger trees and longitudinally cracked in older individuals. The multicoloured, most often yellow or green-grey **leaves** are arranged in a spiral, with 3-10 cm long petioles. The **leaves** come in different shapes; they are most often simple, widely egg-shaped and sharply pointed, 10-20 cm long and 5-15 cm wide, with a rough and leathery dark green upper side and greyish, soft, and hairy underside. The male **flowers** are joined in 6 8 cm long catkins, while female **flowers** form round balls around 2 cm in size. The infructescence is a spherical cluster 2–3 cm wide that contains numerous red or orange **fruits**.

ECOLOGY: Grows best on loose and well-drained soils. It can tolerate winters and droughts but prefers warm and protected sites exposed to the sun. Young trees are very sensitive to late and early frost.

SIMILAR TREES: *Ficus carica, Morus alba*



11 *Broussonetia papyrifera* Vent.

Paper mulberry

Invasiveness

(potentially) invasive in open areas and open forests in warmer sites

Occurrence

Drought tolerance (*)

Frost tolerance

Shade tolerance (*)

Waterlogging tolerance (*)

Allergic potential

(*) Data not available for this species

Catalpa bignonioides Walt.

Southern catalpa, Common catalpa, Cigartree

12

Catalpa

Chêne rouge d'Amérique

Gew. Trompetenbaum

Navadni cigarovec, ameriška katalpa

12 *Catalpa bignonioides* Walt.

Southern catalpa, Common catalpa, Cigartree

Catalpa bignonioides Walt.

Southern catalpa, Common catalpa, Cigartree

12

ORIGIN: South-eastern United States

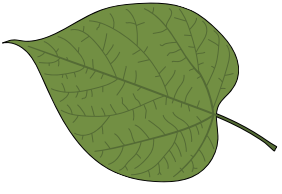
INTRODUCED TO EUROPE: 1726

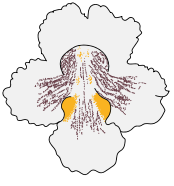
OCCURRENCE IN THE ALPINE SPACE: Parks, gardens, avenues

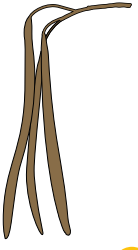
MAIN CHARACTERISTICS: A deciduous tree with a short, thick, twisted trunk that grows up to 20 m in height. Its **bark** is thin, grey-brown, and smooth, but cracks with age. The **leaves** are arranged in whorls of three and are simple, widely egg-shaped, 10-30 cm long, and shortly pointed at the top with a heart-shaped base. Whole-edged or wavy, they are dark green and hairless, lighter below, and mostly have dense, white short hair. The **flowers** have 16 cm long petioles and are grouped into erect, 15-25 cm long, bell-shaped corollas of 5 lobes. They are bisexual, 3-4 cm long, 3-5 cm wide, and white. The calyx and tubular wreath are two-pointed; the upper lip is 2-lobed and the lower one 3-lobed. The white wreath has 2 yellow stripes and numerous red spots. The **fruits** are brown, pod-like capsules 15 to 40 cm long.

ECOLOGY: Optimal conditions for this species are deep, rich, aerated, sandy loam and fresh to humid soils. It likes warm summers, is a semi-heliophyte, and tolerates air pollution. The southern catalpa prefers an open and sunny site to partial shade. Unsuitable conditions are drought and wind, and young plants are susceptible to frost.

SIMILAR TREES: *Catalpa ovata, Catalpa speciosa, Paulownia tomentosa*







12 *Catalpa bignonioides* Walt.

Southern catalpa, Common catalpa, Cigartree

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Catalpa ovata G. Don

Chinese/yellow/Japanese catalpa

13

Catalpa cinese, giallo, giapponese

Catalpa jaune

Gelber Trompetenbaum, Chines. Trompetenbaum

Japonska katalpa

13 *Catalpa ovata* G. Don

Chinese/yellow/Japanese catalpa

Catalpa ovata G. Don

Chinese/yellow/Japanese catalpa

13

ORIGIN: East Asia

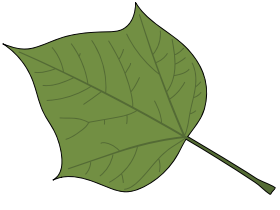
INTRODUCED TO EUROPE: 1849

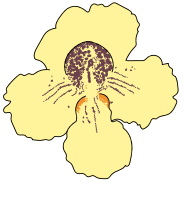
OCCURRENCE IN THE ALPINE SPACE: Parks, gardens

MAIN CHARACTERISTICS: A medium-sized deciduous tree with a short, thick trunk supporting long and straggling branches that form a broad and irregular crown. Grows up to 18 m in height and up to 1 m in diameter. Its **bark** is brown to grey and matures into hard plates or ridges. The **leaves** are heart-shaped and have 3 lobes, with hair in the vein corners on the underside. They are 20-30 cm long and 15-20 cm wide. The **flowers** are 2.5-4 cm across, trumpet-shaped, white with yellow spots inside, and grow in panicles of 20-40. The fruit is a long, thin, bean-like pod 20-40 cm long and 8-10 mm in diameter that often remains attached to the tree during winter. The pod contains numerous flat, light brown **seeds** with two papery wings.

ECOLOGY: Optimal conditions for this species are average, medium to wet, well-drained soils in full sun to partial shade. It can grow in a wide range of soil conditions including both wet and dry soils but prefers moist, fertile loams. It can also tolerate seasonal flooding.

SIMILAR TREES: *Catalpa bignonioides, Catalpa speciosa*





13 *Catalpa ovata* G. Don

Chinese/yellow/Japanese catalpa

Invasiveness

Not considered invasive

Occurrence

Drought tolerance (*)

Frost tolerance

Shade tolerance (*)

Waterlogging tolerance (*)

Allergic potential (*)

(*) Data not available for this species

Cedrus deodara (Roxb.) G.Don

Deodar cedar, Himalayan cedar

14

Cedro dell'Himalaya

Cèdre de l'Himalaya

Himalaya-Zeder

Himalajska cedra

14 *Cedrus deodara* (Roxb.) G.Don

Deodar cedar, Himalayan cedar

Cedrus deodara (Roxb.) G.Don

Deodar cedar, Himalayan cedar

14

ORIGIN: Western Himalaya

INTRODUCED TO EUROPE: 1822

OCCURRENCE IN THE ALPINE SPACE: Parks, gardens, experimental plots in forests

MAIN CHARACTERISTICS: This evergreen conifer grows up to 50 m in height and 3 m in diameter. Younger trees have a conical crown shape with a sagging leading shoot and sagging branches. When trees become older, the crown becomes rounder. The **bark** is grey-brown and smooth in the initial form, then develops typical grooves with age. The **needles** are blue to green, spiky, 3-5 cm long, and grow in groups of around 30. Male **flowers** consist of several stamens. They are erect, oval, yellow, and 4-7 cm long, while female inflorescences are smaller, 2-2.5 cm long, green, and more difficult to spot. The **cones** occur alone or in pairs and are 7-10 cm long and 5-6 cm wide. Their colour switches from blue to reddish brown as they mature. **Seeds** are 17 mm long and 6 mm wide, with 5-6 cm wide **seed** scales that are hairless on the upper side.

ECOLOGY: Optimal conditions for this species are deep and well-drained soils. In its native range it grows on silicate soil, but it also tolerates other types of paternal rock. The deodar cedar likes high air humidity and fresh soil; it is a semi-sciophyte that can tolerate drought, but not as well as other species of the *Cedrus* genus. Young plants are sensitive to cold, fire, and cold wind.

SIMILAR TREES: Other tree species from genera *Cedrus* spp.

14 *Cedrus deodara* (Roxb.) G.Don

Deodar cedar, Himalayan cedar

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Cedrus libani A. Rich.

Lebanon cedar

15

Cedro del Libano

Cèdre du Liban

Libanon-Zeder

Libanonska cedra

15 *Cedrus libani* A. Rich.

Lebanon cedar

Cedrus libani A. Rich.

Lebanon cedar

15

ORIGIN: Mediterranean mountains of Turkey, Syria, and Lebanon

INTRODUCED TO EUROPE: Early 17th century

OCCURRENCE IN THE ALPINE SPACE: Parks, experimental plots in forests

MAIN CHARACTERISTICS: This evergreen conifer has a dense, pyramid-shaped crown when young that develops into a broad umbrella shape with thick horizontal branches as it ages. It grows up to 40 m in height and up to 3 m in diameter. Its **bark** is dark grey and fissured. The dark green **needles** are arranged in clusters of 30-40 on short shoots and have a length of 1.5-3.5 cm. The male **flowers** are cylindrical, 3-5 cm long and yellow during blossoming, while the conical female inflorescences are blue-green ovoids up to 8 mm long that are difficult to see. The brown **cones** are flat or slightly concave, 8-10 cm long and 4-6 cm wide. The **seeds** are 15-18 mm long with 25 mm long wings.

ECOLOGY: Optimal conditions for this species are on limestone parent rock. The Lebanon cedar tolerates drought well, but it is less resistant to extreme climate changes than the Atlas cedar. It requires a lot of warmth for lignification and is a slow-growing heliophyte. The species is unsuitable for environments with dense soil, polluted air, wet snow, or winter temperatures below -16°C, which can lead to cold stress and increased mortality.

SIMILAR TREES: *Cedrus brevifolia*, other tree species from genera *Cedrus* spp.

15 *Cedrus libani* A. Rich.

Lebanon cedar

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Chamaecyparis lawsoniana

(A. Murray bis) Parl.

Lawson cypress, Oregon cedar

16

Cipresso di Lawson

Cyprès de Lawson

Lawsons Scheinzypresse

Lawsonova pacipresa

16 *Chamaecyparis lawsoniana*

(A. Murray bis) Parl.

Lawson cypress, Oregon cedar

Chamaecyparis lawsoniana

(A. Murray bis) Parl.

Lawson cypress, Oregon cedar

16

ORIGIN: Western North America (Oregon and California)

INTRODUCED TO EUROPE: 1854

OCCURRENCE IN THE ALPINE SPACE: Parks, cemeteries, experimental plots in forests

MAIN CHARACTERISTICS: This evergreen conifer has a narrow, pyramid-shaped crown that sags at the top. It grows up to 50 m in height and 3 m in diameter. Its **bark** is reddish-brown and stringy, and can be up to 10-20 cm thick on old trees (1-2 cm thick on trees under about 100 years old). The **leaves** are scale-like, usually 2-3 mm long and pointed. The tiny, oval male **flowers** are pink or red; the female inflorescences are likewise very small, but blue and poorly visible. The **cones**, which are short-stemmed, round, and measure a maximum of 1 cm in diameter, are blue-green until they mature and turn brown. They have fertile scales with 2-4 winged **seeds** around 4 mm long.

ECOLOGY: Optimal growing conditions are deep, fresh, clay or lime soils with sufficient air humidity. The Oregon cedar tolerates moderate drought, wind, air pollution, pests, diseases, and temperatures down to -25°C. It can grow in a wide range of light conditions. Unsuitable conditions are very dry habitats and windstorms.

SIMILAR TREES: *Chamaecyparis nootkatensis, Thuja occidentalis, Thujopsis dolobrata*

16 *Chamaecyparis lawsoniana*

(A. Murray bis) Parl.

Lawson cypress, Oregon cedar

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

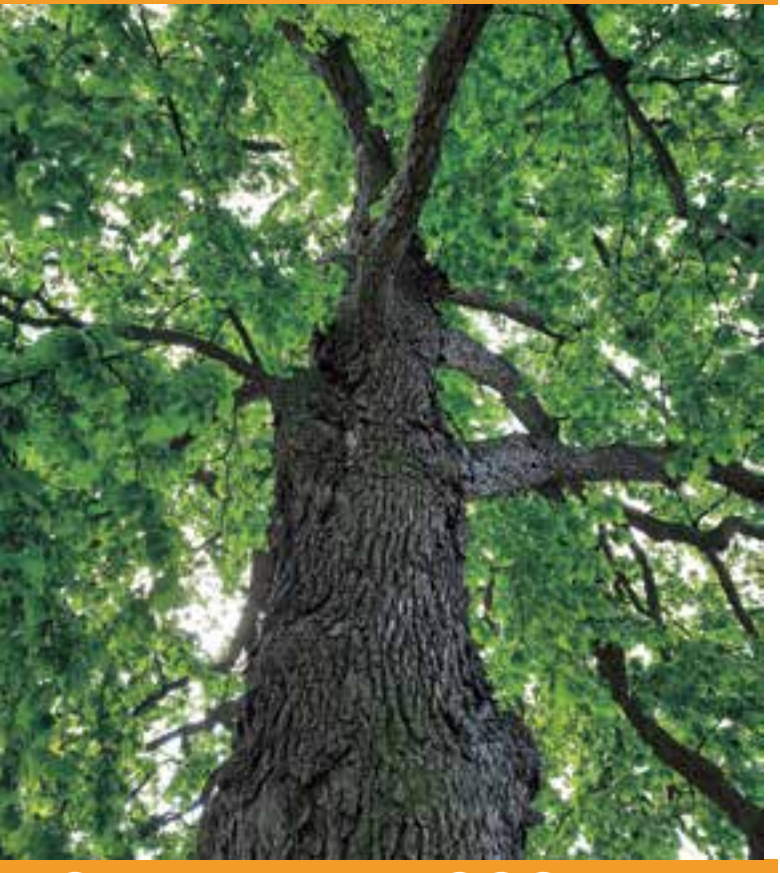
Waterlogging tolerance

Allergic potential

Corylus colurna L.

17

Turkish hazel



Nocciolo di Turchia

Noisetier de Byzance, Coudrier du Levant, Noisetier de Turquie

Baumhasel

Turška leska

17

Corylus colurna L.

Turkish hazel

Corylus colurna L.

Turkish hazel

17

ORIGIN: Balkan peninsula and Anatolia

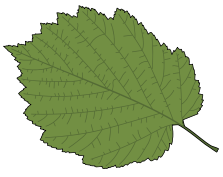
INTRODUCED TO EUROPE: Unknown

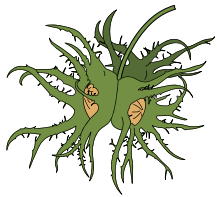
OCCURRENCE IN THE ALPINE SPACE: Parks, roadside avenues

MAIN CHARACTERISTICS: This broad-leaved deciduous tree has a straight trunk and a pyramid-shaped crown that becomes wider, very compact, and notably dark green with age. It grows up to 32 m in height and up to 110 cm in diameter. Its **bark** assumes three different forms depending on dryness: thin with vertical cracks; moderately thick, strip-type **bark** with vertical cracks and flat horizontal stripes; or rough with a thickness up to 2 cm, vertical cracks and a network of scales. The heart-shaped **leaves** with a spiky apex at the base are positioned alternately. They are 7-15 cm long and 5-10 cm wide, hairless above with sparse hairs along the midrib below. The male **flowers** are joined into catkins, which are yellow and 5-10 cm long during blossoming. The female **flowers** are hidden in pairs in a sheath of scaly **leaves** from which only short red filamentous furrows protrude. The fruit is a brown nut (hazelnut), slightly flattened and up to 20 mm long, surrounded by a dense, glandularly hairy sheath of narrow ovate leaves (bracts).

ECOLOGY: Optimal growing conditions are annual mean temperatures of 8-10°C, annual precipitation of 570-850 mm, and a mean relative humidity in July of between 50 and 70 %. The majority of precipitation should fall in the summer. the Turkish hazel can withstand extreme temperatures for a short time and is highly adaptable. It can grow on deep, nutrient-rich, wet to dry forest soils and alluvial soils, but also on nutrient-poor soils with high volumes of organic debris as well as on stony sites endangered by erosion. The species also has a high shade tolerance.

SIMILAR TREES: *Corylus avellana, Corylus maxima*





17

Corylus colurna L.

Turkish hazel

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Cupressus sempervirens L.

18

Italian cypress, Mediterranean cypress

Cipresso italiano,
cipresso mediterraneo

Cyprès commun, cyprès sempervirent,
cyprès toujours vert

Mittelmeer-Zypresse,
Säulen-Zypresse

Vednozelena cipresa

18 *Cupressus sempervirens* L.

Italian cypress, Mediterranean cypress

Cupressus sempervirens L.

Italian cypress, Mediterranean cypress

18

ORIGIN: Eastern Mediterranean region

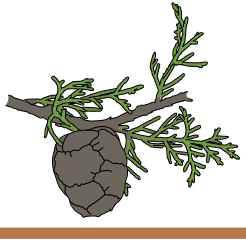
INTRODUCED TO EUROPE: Classical antiquity

OCCURRENCE IN THE ALPINE SPACE: Parks, gardens, cemeteries, along roads

MAIN CHARACTERISTICS: A medium-sized, evergreen conifer. The variety *C. horizontalis* is considered to be the natural form; it develops a broad crown with horizontally protruding branches. The ornamental form *C. pyramidalis* has a compact and conical crown. Individuals can grow up to 35 m in height and 80 100 cm in diameter. The **bark** is thin, longitudinally cracked and dark grey-brown. Its **leaves** are scale-like, grey-green, ovate, and only a few millimetres long, with numerous stomata on the upper side. The yellow to yellow-brown male **flowers** are 3-5 mm long and 2 mm wide while the spherical, greenish female **flowers** are 2,5 mm in size. The round **cones** are quite large, around 4 cm in diameter, and start out green before turning brown. They are composed of 8-14 fertile scales hiding 8-15 winged, flattened **seeds** underneath.

ECOLOGY: Optimal conditions for this species are medium to deep, moist and permeable soils with at least moderate nutrient supply. It needs plenty of light and can grow on almost all alkaline or slightly acidic soils, though it prefers clay soil on limestone. It tolerates heat, drought, and polluted air and is resistant to strong wind. The Mediterranean cypress is a heliophyte and does not tolerate low temperatures well.

SIMILAR TREES: *Cupressus arizonica, Chamaecyparis lawsoniana, Thuja occidentalis*



18 *Cupressus sempervirens* L.

Italian cypress, Mediterranean cypress

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Fraxinus pennsylvanica Marshall

19

Green ash

Frassino verde,
frassino americano

Frêne rouge,
Frêne rouge de Pennsylvanie

Rotesche

Pensilvanski jesen

19 *Fraxinus pennsylvanica* Marshall

Green ash

Fraxinus pennsylvanica Marshall

Green ash

19

ORIGIN: North America

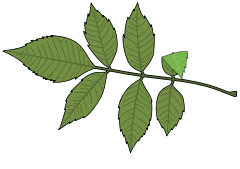
INTRODUCED TO EUROPE: 18th century

OCCURRENCE IN THE ALPINE SPACE: Floodplain forests, parks, avenues, windbreaks

MAIN CHARACTERISTICS: A medium to tall deciduous tree with a high, rounded crown. In its native range, the trunk is typically straight, but irregular stem forms can be found in Europe. It can grow up to 40 m in height and 2 m in diameter. The **bark** is usually brown with shallow ruts. The pinnately compound **leaves** have a length of 20-30 cm and contain 7-9 lanceolate leaflets that are 10-15 cm long and finely serrate. The upper side of the leaflets is dark green in colour, with a smooth and taint surface, while the underside is pale green and hairy with a narrowly winged stalk. The green to purplish male and female **flowers** grow on different plants in small clusters. The female **flowers** turn brown after pollen release. The fruit is a samara with winged **seeds** that turns from light green to yellow and then to tan as it ripens.

ECOLOGY: Optimal growing conditions are heavy and wet soils with long-lasting flooding events lasting up to 40 percent of the vegetation period. The green ash is fairly undemanding with regard to site conditions and has a broad physiological amplitude. It is closely connected to alluvial soils in riparian forests and dry, well-nourished open soils. Its vertical distribution is strictly limited to lowlands up to 900 m a.s.l. that are flooded at least once annually. The green ash grows on soils with low as well as very high pH values and can withstand high amounts of salt. As a pioneer species, it does not tolerate shade well.

SIMILAR TREES: *Fraxinus americana, Fraxinus excelsior, Fraxinus angustifolia*



19 *Fraxinus pennsylvanica* Marshall

Green ash

Invasiveness

(potentially) invasive in open riparian and alluvial forest

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Ginkgo biloba L.

Kew tree

20

Kew tree

L'Arbre aux quarante écus, l'Abricotier d'argent, Ginkgo

Ginko

Dvokrpi ginko

20 *Ginkgo biloba* L.

Kew tree

Ginkgo biloba L.

Kew tree

20

ORIGIN: China

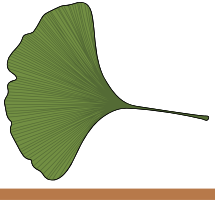
INTRODUCED TO EUROPE: 18th century

OCCURRENCE IN THE ALPINE SPACE: Parks, along streets

MAIN CHARACTERISTICS: This deciduous tree grows in a pyramidal shape, with a columnar, sparingly branched trunk. It can reach up to 30 metres in height and 2 m in diameter. Its fissured, greyish **bark** is deeply furrowed on older trees and has a corky texture. The fan-shaped, leathery **leaves** resemble the leaflets of the maidenhair fern and are borne on short, spur-like but very thick shoots. The **leaves** are up to 15 cm long and sometimes twice as wide, with most of them divided into two lobes. They are dull grey-green to yellow-green in summer and turn a golden yellow in autumn. The male **flowers** appear as catkins around 5 cm long, while the female **flowers** are arranged in pairs on a stalk about 1 cm long. The **fruits** are yellowish and plumlike, about 3 cm long, and consist of a large inner nutlike **seed** surrounded by a fleshy outer covering (sarcotesta).

ECOLOGY: In cultivation, it tolerates a wide variety of seasonal climates ranging from Mediterranean to cold temperate, with winter temperature minimums of 20°C. It grows best when planted in full sun, however. The ginkgo has the ability to persist under low light and low nutrient conditions. In its native range, trees grow on degraded sites, along stream beds, on rocky slopes and the edges of soil beds. The distribution of ginkgo fossils indicates that the species prefers warm temperate climates with moist summers and cool winters. It does not perform well in subtropical climates or on soils that are overly wet or dry during the growing season.

SIMILAR TREES: -



20 *Ginkgo biloba* L.

Kew tree

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Gleditsia triacanthos L.

21

Honey locust

Spino di Giuda

Févier d'Amérique

Gleditschie, Lederhülsenbaum

Trnata gledičevka

21 *Gleditsia triacanthos* L.

Honey locust

Gleditsia triacanthos L.

Honey locust

21

ORIGIN: North America

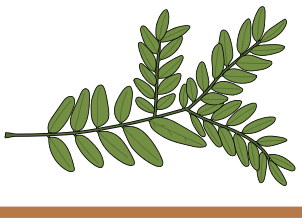
INTRODUCED TO EUROPE: Around 1700

OCCURRENCE IN THE ALPINE SPACE: Urban areas, parks, along water bodies

MAIN CHARACTERISTICS: This deciduous, monoecious tree is pollinated by insects and grows up to 40 m in height and 1.5 m in diameter. Its root system can reach up to 6 m in deep soils. The **seeds** (maturing in September-October) start developing at age 10 and continue until the age of 100. The **bark** of the honey locust is smooth when young and later breaks up into long narrow plates. The buds, shoots, and branches are covered with strong, sharp, 20 cm long red-brown thorns. The **leaves** are pinnately compound, 30 cm long and poisonous. It reproduces with **seeds**.

ECOLOGY: Grows on fresh, intensively wet-dry, weakly acidic to neutral, moderately nutritious, semi-shady sites in warm zones. It has an excellent tolerance for high temperatures but is stressed by drought. When young trees are exposed to low temperatures, snow can break branches. The honey locust is suitable for erosion control, as its roots stabilize the ground well. The root system exhibits great flexibility and is able to adapt its size and shape to specific site conditions. Tolerates polluted air and salt well.

SIMILAR TREES: *Gleditsia capsica, Gleditsia japonica*



21

Gleditsia triacanthos L.

Honey locust

Invasiveness

(potentially) invasive in open areas

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Juglans nigra L.

Black walnut, American walnut

22

Noce nero, noce americano

Noyer noir

Schwarznuss

Črni oreh

22 *Juglans nigra* L.

Black walnut, American walnut

Juglans nigra L.

Black walnut, American walnut

22

ORIGIN: Eastern and western USA

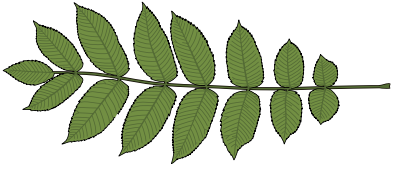
INTRODUCED TO EUROPE: Early 17th century

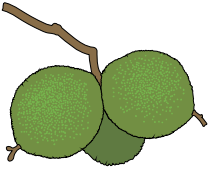
OCCURRENCE IN THE ALPINE SPACE: Forest plantations, ornamental tree in parks and urban areas

MAIN CHARACTERISTICS: Can grow to a height of 38 m, but generally reaches around 25 m. It has very large, alternate, pinnately compound **leaves** with 9-25 aromatic leaflets. The twigs feature a prominently chambered pith. It produces large, leathery, terminal **fruits** (botanically a false drupe) containing a single thick-shelled **seed**. Seed crops are irregular. Seed production can be abundant every 3-5 years. The **bark** is dark grey or brown in youth; in older trees, it can become almost black (giving the species its common name) and deeply cracked into regular patterns. The young sprouts are densely hairy. The buds are yellow-brown, hairy, and sticky, and the terminal bud is larger than the lateral buds.

ECOLOGY: Optimal growing conditions for are deep, rich, loose, moist soils in lowlands, preferably in river valleys. It cannot tolerate heavy clay soils or habitats that are flooded for long periods. The black walnut is a heliophyte that can withstand moderate drought and temperatures down to -30°C, though frost can damage young trees. Compared to *Juglans regia*, it grows faster, better, and is more resistant to diseases and pests.

SIMILAR TREES: *Juglans* x *intermedia, Fraxinus excelsior*





22

Juglans nigra L.

Black walnut, American walnut

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Koelreuteria paniculata Laxm.

23

Golden rain tree, Pride of India, China tree

Albero delle lanterne cinesi, Barnaba, albero dei rosari

Savonnier de Chine, Bois de Panama, Arbre aux lanternes

Blasenesche

Latnati mehurnik

23 *Koelreuteria paniculata* Laxm.

Golden rain tree, Pride of India, China tree

Koelreuteria paniculata Laxm.

23

Golden rain tree, Pride of India, China tree

ORIGIN: Korea, China, Japan

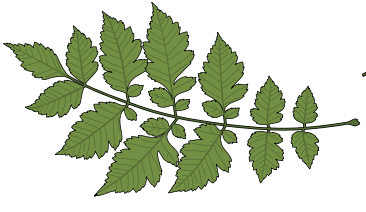
INTRODUCED TO EUROPE: 1770

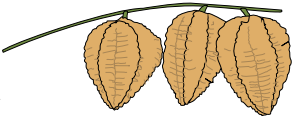
OCCURRENCE IN THE ALPINE SPACE: Riparian forests, urban habitats, ruderal sites

MAIN CHARACTERISTICS: Can grow up to 15 m in height and has a round, broad crown. The **bark** is thick, gray-black, and longitudinally furrowed. The young shoots are initially hairy, the buds large and ovoid. Leaves are up to 35 cm long and 18 cm wide and consist of 7-15 leaflets with deeply serrate margins. Panicle-like, loose inflorescences with yellow **flowers** about 1 cm in size appear in July and August. These ripen into ovoid capsule **fruits** in a yellow-green, later light brown, papery, inflated, three-lobed case, each with 3 black **seeds**. They vary in size and shape and germinate with difficulty because of the hard seed coat.

ECOLOGY: An undemanding species, the golden rain tree prefers deep, fertile, well-drained soils and tolerates basic and acidic soils. As it requires warmth and light and can withstand moderate drought, it should be planted on sunny sites. Can also tolerate low temperatures. Younger individuals are more sensitive, wind tolerant. Does not tolerate salinity.

SIMILAR TREES: *Staphylea pinnata*





23 *Koelreuteria paniculata* Laxm.

Golden rain tree, Pride of India, China tree

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Larix kaempferi (Lamb.) Carr.

24

Japanese larch

Larice del Giappone

Mélèze du Japon

Japanische Lärche

Japonski macesen

24 *Larix kaempferi* (Lamb.) Carr.

Japanese larch

Larix kaempferi (Lamb.) Carr.

Japanese larch

24

ORIGIN: Honshu Island, Japan

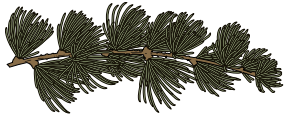
INTRODUCED TO EUROPE: 1834

OCCURRENCE IN THE ALPINE SPACE: Parks, forest plantations

MAIN CHARACTERISTICS: A coniferous tree with a translucent and conical to broadly columnar crown that can reach heights up to 30 m. The trunk is round and straight, with long, horizontally spreading first order branches and short, slender, drooping second order branches. The initially dense and conical crown becomes irregular and more open with age (faster on exposed sites). The **bark** is smooth and red-brown on young trees, later becoming scaly and eventually fissured with a dark brown to grey colour. The grey-green or blue-green **leaves** are deciduous, turning bright yellow in autumn. They are spirally arranged on long shoots, up to 6 cm long and 2 mm wide, with two white stomatal bands on the underside. The **seed cones** are erect, terminal on short shoots, with short, curved, pustulate peduncles. They are characterised by scales with apex recurved margins curling back. The **seeds** are obovate or triangular-obovate, grey-brown mottled with red, slightly flattened, and around 4 mm long and 3 mm wide. They **flower** in March or April.

ECOLOGY: The Japanese larch is appreciated for its fast growth and excellent production in different types of soils. It requires more humidity and longer vegetation periods compared to the European larch, but it grows quickly and can tolerate wind and polluted air. It is also more resistant to various diseases that damage the European larch. It tolerates shade and is adapted to oceanic climates with rainy summers. Growth slows down at an age of 30-40 years.

SIMILAR TREES: *Larix* x *eurolepis* (hybrid between *Larix decidua* and *Larix kaempferi*), *Larix sibirica*



24 *Larix kaempferi* (Lamb.) Carr.

Japanese larch

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Liquidambar styraciflua L.

25

American sweetgum

Storace americano

Copalme d'Amérique, Liquidambar

Amerikanischer Amberbaum

Ameriški ambrovec

25 *Liquidambar styraciflua* L.

American sweetgum

Liquidambar styraciflua L.

American sweetgum

25

ORIGIN: Eastern and south-eastern North America

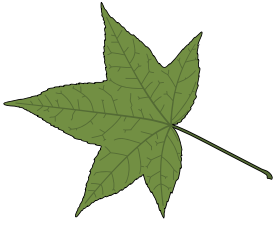
INTRODUCED TO EUROPE: 1680

OCCURRENCE IN THE ALPINE SPACE: Ornamental tree in parks, gardens, and other public areas

MAIN CHARACTERISTICS: Can reach heights of up to 25 m, occasionally even 40 m. The **bark** is grey-brown and deeply cracked. The young shoots are green or brown and hairy. Leaves are 10-18 cm long and wide with serrate margins, dark green and shiny on top and a lighter colour below. The stalks are 6-12 cm long. In autumn, the **leaves** turn yellow, orange, purple, or red and remain on the tree for a long time. The American sweetgum produces large numbers of lightweight **seeds**, with individuals beginning **seed** production at around 20 to 30 years of age and crops remaining abundant for about 150 years. The **seeds** are mainly dispersed by wind.

ECOLOGY: Optimal growth conditions are on moderately coarse to fine soils that are well-drained and slightly acidic (pH 6.1- 6.5). Trees develop a deep taproot with numerous highly developed laterals on well-drained bottomland sites and a shallow, widespread root system on poorly drained sites. The American sweetgum is very intolerant of shade but can withstand flooded soils. Can grow on seaside sites if it is protected from strong winds.

SIMILAR TREES: *Liquidambar orientalis*



25 *Liquidambar styraciflua* L.

American sweetgum

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Liriodendron tulipifera L.

Tuliptree

26

Liriodendro, Albero dei tulipani

Tulipier de Virginie, arbre aux lis

Tulpenbaum

Tulipanovec

26 *Liriodendron tulipifera* L.

Tuliptree

Liriodendron tulipifera L.

Tuliptree

26

ORIGIN: Eastern North America

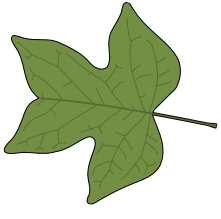
INTRODUCED TO EUROPE: Around 1660

OCCURRENCE IN THE ALPINE SPACE: Urban gardens, parks, scientific experimental plots of forest research institutions

MAIN CHARACTERISTICS: This deciduous species grows up to 40-60 m in height and 150 cm in diameter. Young trees have a narrow and conical crown that becomes denser and more columnar with age. The **bark** is finely fissured and grey, brown, or brown-orange in colour. Young branches are hairless with clearly visible leaf scars. The buds are slightly curved, oval, and up to 1 cm long. The stalked **leaves** are rectangular and divided into four unequal lobes. They grow 10 to 15 cm long and 12 to 20 cm wide, with a shiny upper side and a lighter underside. The bell-shaped **flowers** stand singly at the ends of the branches. The base of the petals is greenish, the mid-section yellow-orange, and the tip greenish again. Around the centre of the **flower** are numerous stamens, and the conical ovaries reaching a size of 6-8 cm are located on a cone in the middle of the blossom. The **flower**ing period is April to May. The **seeds** are winged. The tuliptree exhibits high growth rates and exceptionally straight growth in suitable locations and develops a deep root system. Individuals can reach an age of up to 300 years.

ECOLOGY: A light-demanding species that thrives best in permeable, moist, nutrient-rich, slightly acidic soils. Though generally hardy, it is susceptible to late frosts and does not tolerate dry or stagnant, wet soils. It rarely occurs in pure stands in its native area, but instead in mixtures with Canadian hemlock, oak, black walnut, pine, and black locust.

SIMILAR TREES: *Liriodendron chinese*



26 *Liriodendron tulipifera* L.

Tuliptree

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Magnolia grandiflora L.

27

Southern magnolia, Bull bay

Magnolia sempreverde

Magnolia à grandes fleurs,
magnolier à grandes fleurs

Immergrüne Magnolie

Velecvetna magnolija

27 *Magnolia grandiflora* L.

Southern magnolia, Bull bay

Magnolia grandiflora L.

Southern magnolia, Bull bay

27

ORIGIN: Southern United States

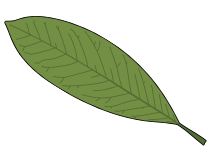
INTRODUCED TO EUROPE: 1737

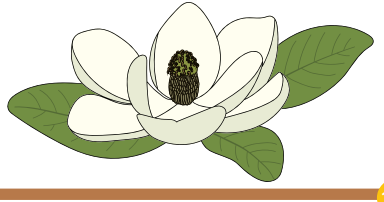
OCCURRENCE IN THE ALPINE SPACE: Ornamental tree in gardens, parks, along roads, and on experimental plots of forestry research institutes

MAIN CHARACTERISTICS: The only evergreen magnolia species. It reaches heights of up to 35 m and diameters of 50-75 cm. The crown is short, densely leafed, and pyramid-shaped. The trunk is grey with thin **bark** and a typical strong trunk base. Young branches have dense hair on the **bark** and buds, while older branches are thin and hairless. The southern magnolia first forms a taproot system, then an extensive cordate root system. The **leaves** are leathery, lanceolate, and tapered towards the tip. They grow up to 25 cm long and 6-10 cm wide. The upper side of the **leaves** is glabrous and shiny green, while the underside is red-brown and hairy or likewise glabrous. The stipules are dense underneath, brown to silky beige. The characteristic **flowers** are white and 15-30 cm wide, with a flowering period from May to June. At the centre of the flower are numerous stamens with purple filaments. The aggregate fruit is cylindrical in shape and 7 to 10 cm long, with soft brownish hairs.

ECOLOGY: This species' distribution is limited by long cold winters and long periods of late frost. However, it tolerates short periods of late frost and sub-zero temperatures without problems if the basic climate is suitable. *M. grandiflora* thrives in the mild areas of Great Britain, the Mediterranean, and south of the Alps, though variations exist that also exhibit good growth results in the northern part of the Alps. In Central Europe, continuous watering is required.

SIMILAR TREES: *Prunus laurocerasus*, other species from genera *Magnolia* spp.





27 *Magnolia grandiflora* L.

Southern magnolia, Bull bay

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Magnolia x soulangeana Soul.-Bod.

28

Lenne`s magnolia, Saucer magnolia

Magnolia giapponese

Magnolia de Chine,
Magnolia de Soulange

Tulpenmagnolie

Sulanževa magnolija

28 *Magnolia x soulangeana* Soul.-Bod.

Lenne`s magnolia, Saucer magnolia

Magnolia x soulangeana Soul.-Bod.

Lenne`s magnolia, Saucer magnolia

28

ORIGIN: Hybrid from Asia

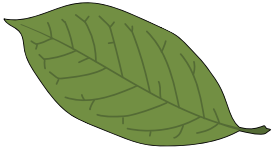
INTRODUCED TO EUROPE: 1820

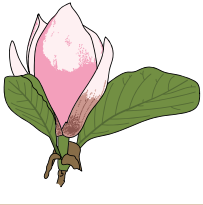
OCCURRENCE IN THE ALPINE SPACE: Gardens, parks, and urban areas

MAIN CHARACTERISTICS: This deciduous tree or shrub with a spreading crown reaches a height of up to 9 m. Its trunk is short with a grey-brown, initially smooth **bark** that becomes finely fissured with age. The **leaves** are alternately arranged, 12 to 20 cm long and up to 6 cm wide. They have short stems, smooth edges, and a matt, fresh green colour on the upper side, while the underside is slightly lighter and hairy. The buds are enclosed by two silky-haired **leaves**. The tulip-like **flowers** grow up to 15 cm wide and have up to 12 thickly fleshed petals that are pink on the outside and white on the inside. They appear from April to May and stand upright at the ends of the branches. Inside the **flowers** are numerous red stamens and fruit petals. The cylindrical, reddish **fruits** are curved and contain few **seeds**. The root system is shallow but extends widely.

ECOLOGY: The saucer magnolia thrives as a solitary tree on deep, moist, humus-rich, and slightly acidic soils. It needs sunny, wind-protected locations with a good nutrient supply and does not tolerate drought or compact soils. It grows well with sun exposure and can tolerate only little shade. As the flower buds are sensitive to frost, it must be planted in sheltered, warm sites. Young plants are more sensitive. It can tolerate polluted cities.

SIMILAR TREES: *Magnolia hypoleuca*





28 *Magnolia x soulangeana* Soul.-Bod.

Lenne`s magnolia, Saucer magnolia

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Paulownia tomentosa (Thunb.) Steud.

29

Princess tree, Empress tree, Kiri tree

Paulonia

Paulownia

Paulownie, Blauglockenbaum

Pavlovnija

29 *Paulownia tomentosa* (Thunb.) Steud.

Princess tree, Empress tree, Kiri tree

Paulownia tomentosa (Thunb.) Steud.

Princess tree, Empress tree, Kiri tree

29

ORIGIN: Central and western China

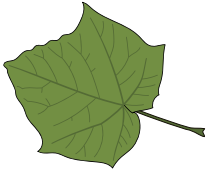
INTRODUCED TO EUROPE: Early 19th century

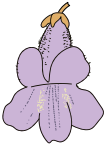
OCCURRENCE IN THE ALPINE SPACE: Urban areas, industrial wastelands, along railways and roads, clearings, forest margins, cliffs, steep rocky slopes, riverbanks, disturbed habitats, plantations

MAIN CHARACTERISTICS: This deciduous tree with an umbrella-shaped crown grows up to 20 m in height. It is considered one of the world's fastest growing tree species, with increments of >1 m per year. The **bark** is smooth and pale yellow to brown, has numerous large lenticels when young, and becomes rough and grey-brown with age. The deciduous **leaves** are oppositely positioned, have an acuminate, cordate, or broadly ovate shape, and are 20-50 cm long and 10-30 cm wide when mature. They are light green above and pale-green and tomentose below. The buds are hairy and orange-brown. The hermaphroditic, stalked, and vanilla-scented fivefold **flowers** appear in peduncled inflorescences between April and May, before the **leaves** shoot. They are elongated (5-7 cm long), bell-shaped, and light pink, purple to blue-violet, or white in colour. The **fruits** are brown, pointed, ovoid woody capsules 2.5-4 cm in length. The **seeds** remain viable for 2-3 years and are easily transported over long distances by water or wind. The princess tree can reproduce also vegetatively via regrowth of root or stem material.

ECOLOGY: A pioneer species preferring deep, fertile, fresh, airy alluvial soils with little limestone. Does not grow on poor soils. Sensitive to low temperatures, young trees are often damaged by frost, but they regenerate in spring. A light-demanding species, it is resistant to stress factors like extreme summer temperatures and low water availability during periods of drought in urban areas.

SIMILAR TREES: *Catalpa bignonioides*





29 *Paulownia tomentosa* (Thunb.) Steud.

Princess tree, Empress tree, Kiri tree

Invasiveness

(potentially) invasive in open forests

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Picea omorika (Pančič) Purkyne

Serbian spruce

30

Peccio di Serbia

Épicéa de Serbie

Serbische Fichte

Omorika,
Pančićeva smreka

30

Picea omorika (Pančič) Purkyne

Serbian spruce

Picea omorika (Pančič) Purkyne

Serbian spruce

30

ORIGIN: Mountainous central Balkan region in the border area between Serbia, Bosnia, and Herzegovina

INTRODUCED TO EUROPE: Native to Europe

OCCURRENCE IN THE ALPINE SPACE: Gardens, parks

MAIN CHARACTERISTICS: Grows up to 50 m in height and 1 m in diameter. When mature, trees have short hanging branches with upward-pointing tips and blue-green **needles** on the lower surface. When young, the crown is comparatively wider, and the branches do not stand upright. The grey-brown **bark** is thin, has a small number of resin channels, and sheds in roundish scales. P. omorika forms a very shallowed and branched root system. The terminal bud is often covered by **needles**. The outer bud scales are lanceolate, long, and pointed compared to the inner bud scales, which are shorter, ovate, and blunt. Flower buds are larger and dorsiformally flattened. The young shoots are densely hairy, with furrows in the light brown **bark**. The **flowering** period in Central Europe is between May and June. In its natural range, one mast year occurs every 3 to 4 years. The **seeds** are black-brown and carry an 8 mm long and 5-6 mm wide, broadly rounded wing.

ECOLOGY: The Serbian spruce grows on steep, rocky, hard-to-reach north slopes with limestone, where it can compete with other species. It grows best in humid areas but also tolerates dry or even moister sites. Soils can be alkaline or acidic or even poor. Can withstand cold and frost, polluted city air, and heavy snow.

SIMILAR TREES: *Picea abies, Picea sitchensis*

30 *Picea omorika* (Pančič) Purkyne

Serbian spruce

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Picea pungens Engelm.

Colorado Spruce, Blue spruce

31

Abete del Colorado

Epicéa bleu, épinette bleue, épicéa bleu du Colorado

Stech-Fichte

Bodeča smreka

31 *Picea pungens* Engelm.

Colorado Spruce, Blue spruce

Picea pungens Engelm.

Colorado Spruce, Blue spruce

31

ORIGIN: Rocky Mountains of Colorado and Utah, USA

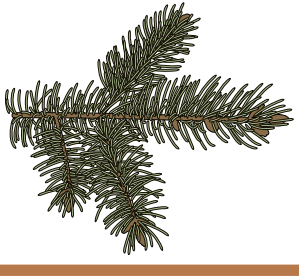
INTRODUCED TO EUROPE: 18th century

OCCURRENCE IN THE ALPINE SPACE: Parks, gardens

MAIN CHARACTERISTICS: Subalpine species that grows up to 30 m in height and lives up to 400 years in the wild. It has a wide, dense, cony canopy. The **bark** is brown-grey with scales that fall from the **bark**. Old trees have thick and deeply cracked **bark**. Shoots are light yellow or orange in colour, thick and hairless; buds are 6-9 mm long, egg-shaped or oval. The **needles** are 2-3 cm long, 1 mm thick, strong, sharp, and a blue-silver colour. They are usually covered in a waxy layer and have a strong bitter taste. The light brown **cones** are 6-9 cm long and 2-3 cm thick. They ripen in September and stay on the tree for 2-3 years. The blue spruce does not have high economic value in its natural range, as the wood is of medium quality and has many knots.

ECOLOGY: An undemanding tree that tolerates city pollution the best among all spruces. Grows at altitudes between 1,800 and 3,300 m. Thrives on acidic and alkaline soils and can tolerate dry air, summer drought, wind, and snow. It withstands low autumn and winter temperatures but can be affected by late autumn frost. The blue spruce grows slowly while young and tolerates cutting well.

SIMILAR TREES: *Picea engelmanii*



31 *Picea pungens* Engelm.

Colorado Spruce, Blue spruce

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Picea sitchensis (Bong.) Carr.

32

Sitka spruce

Peccio di Sitka

Epicéa de Sitka

Sitka-Fichte

Sitka smreka

32 *Picea sitchensis* (Bong.) Carr.

Sitka spruce

Picea sitchensis (Bong.) Carr.

Sitka spruce

32

ORIGIN: Western North America

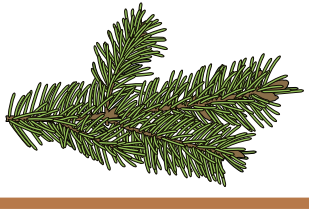
INTRODUCED TO EUROPE: 18th century

OCCURRENCE IN THE ALPINE SPACE: Mainly in forest plantations

MAIN CHARACTERISTICS: A large conifer whose appearance is characterized by the straight trunk and the horizontal branches of the open, conical crown. In its native range, it reaches heights of up to nearly 80 metres. Individuals in Europe unusually can reach heights of 50 m and can live for 500 years. In combination with its good growth rate, this species is very important for silvicultural plantations and has the highest values of increment at between 70 and 160 years. It has a thin, reddish-brown, flaky **bark** and is inflexible and with spiky **needles** with a length from 1.5 to 2.5 cm. The pollen is distributed by wind. Seed production begins at the age of 20 to 25 in **cones** 5 to 10 cm long. This species can be identified by its paper-like **bark** flakes with wavy, irregularly toothed edges. The **seeds** are 2 to 3 mm long and attached to a wing with a length of about 8 mm.

ECOLOGY: The Sitka spruce prefers coastal climates with annual precipitation of over 1,000 mm. It requires humid conditions and prefers deep and nutritious soils allowing rooting depths up to 2 m. It does not do well in sites with compaction in the upper soil level and waterlogging, conditions that contribute to a very flat rooting system and the risk of windthrows. Optimal conditions in its native range are found in alluvial stands or on hygroscopic slopes where heights up to 60 or 80 m can be reached. To germinate well, the seeds need bare mineral soil.

SIMILAR TREES: *Picea abies*



32 *Picea sitchensis* (Bong.) Carr.

Sitka spruce

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Pinus strobus L.

Eastern white pine, Weymouth pine

33

Pino bianco americano,
pino di Weymouth

Pin blanc, Pin du Lord,
Pin de Weymouth

Strobe,
Weymouth-Kiefer

Zeleni bor

33 *Pinus strobus* L.

Eastern white pine, Weymouth pine

Pinus strobus L.

Eastern white pine, Weymouth pine

33

ORIGIN: North-eastern part of North America

INTRODUCED TO EUROPE: 1705

OCCURRENCE IN THE ALPINE SPACE: Forest plantations, gardens, and parks

MAIN CHARACTERISTICS: This evergreen tree grows up to 50 m in height, has a straight trunk with a diameter of up to 1.8 m, and a conical crown that becomes rounded to flattened with age. Its **bark** is soft, greenish-grey to grey-brown and smooth at a young age, later becoming deeply furrowed with long, irregularly rectangular, scaly plates. Its branches are whorled, spreading, and upswept. The twigs are slender and flexible.

The **needles** are joined in groups of five, 6-10 cm long, thin (0.7-1 mm), and straight or slightly twisted. They are pliant and persist on the tree for 2-3 years. The **needles** have 3 sides; one side is green and glossy while the other two are glaucous to blue-green and matt. The **cones** are slender, cylindric, 8-20 cm long and 20-25 mm wide. The **seeds** are clustered and mature in 2 years. They are 5-6 mm long, obovoid and thin-skinned, red-brown mottled with black, and have 18-25 mm long wings. The roots spread wide. Growth is slow, and the wood is light but hard. Its **needles** are used to produce turpentine. Often affected by blister rust (*Cronartium ribicola*).

ECOLOGY: The eastern white pine has a wide ecological range. It can grow in regions with harsh and mild winters and at elevations from sea level up to 2,200 m. It requires a good water supply and enough summer heat but has low soil and nutrient requirements. It can withstand extreme temperatures, humidity, and high variability in the water regime, though it prefers well-drained soils and cool, humid climates.

SIMILAR SPECIES: *Pinus nigra, Pinus ponderosa, Pinus wallichiana*

33

Pinus strobus L.

Eastern white pine, Weymouth pine

Invasiveness

(potentially) invasive in rocky areas and in mesophilous forests

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Pinus wallichiana A. B. Jacks.

34

Himalayan pine, Himalayan white pine

Pino dell'Himalaya

Pin pleureur de l'Himalaya

Tränenkiefer, Seidenföhre

Himalajski bor

34 *Pinus wallichiana* A. B. Jacks.

Himalayan pine, Himalayan white pine

Pinus wallichiana A. B. Jacks.

34

Himalayan pine, Himalayan white pine

ORIGIN: Mountainous regions of lower Asia. Natural stands are distributed across Afghanistan, Pakistan, India, Nepal, Bhutan, Tibet, China, and Burma.

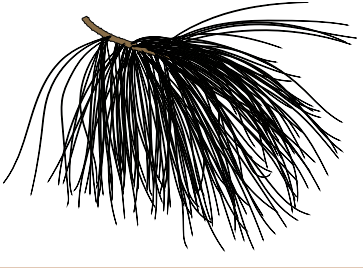
INTRODUCED TO EUROPE: Beginning of 19th century

OCCURRENCE IN THE ALPINE SPACE: Mainly as an ornamental tree in parks and gardens.

MAIN CHARACTERISTICS: Can grow up to 50 meters in height but is more often 10-30 meters high. The **leaves** (**needles**) grow in fascicles (bundles) of five and are 12-18 cm long. They are known for being flexible along their length, and often droop gracefully. The **cones** are long and slender, 16-32 cm. The **seeds** are 5-6 mm long with a 20-30 mm wing. The grey **bark** of young trees is smooth; it becomes fissured and turns dark brown with age.

ECOLOGY: Grows on light (sandy), medium (loamy), and heavy (clay) soils, prefers well-drained soil, and can tolerate nutrient-poor soils. Suitable soil pH is acidic to neutral. Low tolerance for shade.

SIMILAR TREES: *Pinus strobus*



34 *Pinus wallichiana* A. B. Jacks.

Himalayan pine, Himalayan white pine

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Platanus x *acerifolia* (Aiton) Willd.

35

London planetree

Platano comune

Platane commun

Ahornblättrige Platane

Javorolistna platana

35 *Platanus* x *acerifolia* (Aiton) Willd.

London planetree

Platanus x *acerifolia* (Aiton) Willd.

35

London planetree

ORIGIN: A crossbreed between *Platanus orientalis* (Oriental plane tree) indigenous to Greece and Asia Minor and *Platanus occidentalis* (American sycamore), which grows in the forests of the eastern United States. It originated as a chance seedling in a botanical garden where both parent species happened to be growing together.

INTRODUCED TO EUROPE: The tree was first discovered in London in 1663.

OCCURRENCE IN THE ALPINE SPACE: Popular street tree; also found in parks, squares, theme parks, cemeteries, large gardens.

MAIN CHARACTERISTICS: The London plane tree is a deciduous tree with widely spreading branches, maple-like **leaves**, and a flaky **bark**. It is also known for its dangling, spiky round clusters of **fruits**. The **bark** is brownish or greyish, thin, and peels off, leaving yellow spots behind. Leaves are arranged alternatingly and palmately lobed, with 3 to 5 main lobes. Flowers are tiny, borne in round clusters on long stalks. The green male and red female **flowers** grow in separate clusters on the same tree. **Fruits** appear in aggregates of hundreds in balls around 2.5 cm across. Each tiny fruit has a tuft of hair to aid dispersal. The tree grows fast and can reach up to 40 m in height.

ECOLOGY: Grows in full sun or light shade. It prefers deep, rich, moist, well-drained soil, but will grow in most soils. It tolerates lower temperatures better than other plane trees; it is also well-adapted to city environments.

SIMILAR TREES: *Platanus* x *hispanica, P. orientalis, P. occidentalis*

35 *Platanus x acerifolia* (Aiton) Willd.

London planetree

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

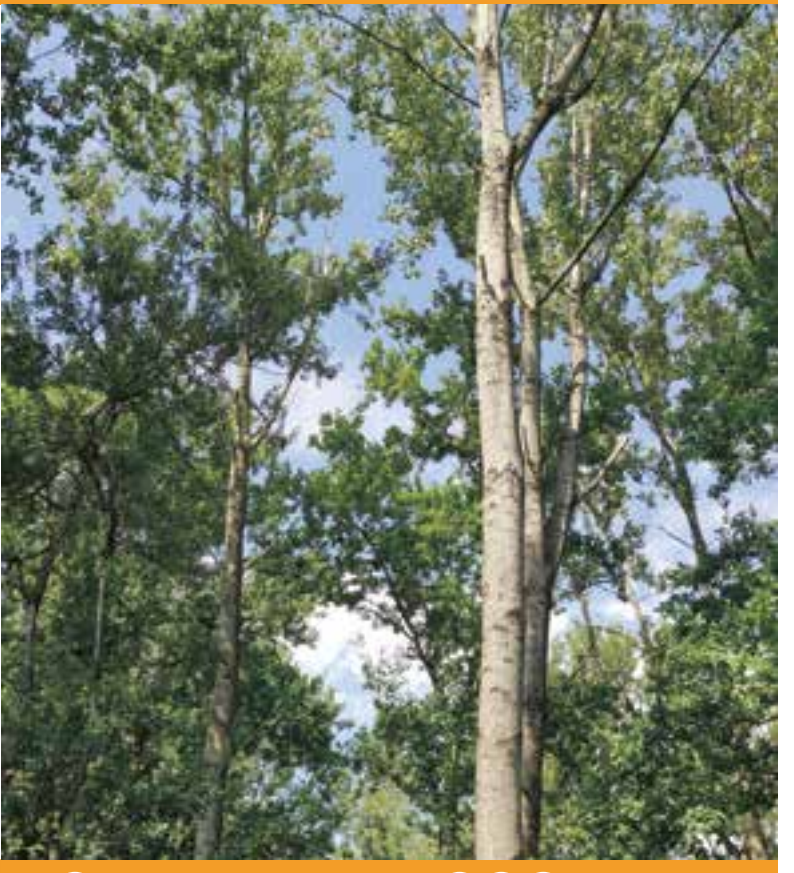
Waterlogging tolerance

Allergic potential

Populus x canadensis Moench

Canadian poplar

36



Pioppo canadese

Peuplier du Canada,
Peuplier noir hybride

Hybrid-Pappel,
Bastard-Pappel

Kanadski topol

36 *Populus x canadensis* Moench

Canadian poplar

Populus x *canadensis* Moench

Canadian poplar

36

ORIGIN: *Populus* x *canadensis* is obtained by crossing *Populus nigra* (spontaneous occurrence in the Alpine space) and *Populus deltoides* (spontaneous occurrence in eastern Canada and USA). Created in the 18th century.

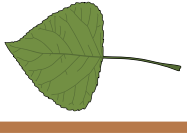
INTRODUCED TO EUROPE: Around 1750

OCCURRENCE IN THE ALPINE SPACE: This species is found especially in the Alpine mountains (in valleys, along rivers), where it is planted by humans. It is mostly planted on plantations, next to roads and motorways, in parks, and as windbreaks.

MAIN CHARACTERISTICS: A large, fast-growing tree species with an invasive root system. The trunk is straight and often very tall (up to 30-40 m). The **bark** is grey or greyish-brown, smooth when young, and becomes fissured with age. It is characterised by its **leaves**, which are not rhomboidal respectively deltoidal and narrow like in the parent trees but instead large, triangular or deltoidal, and wide. The shoots often have cilia, and there are usually glands at the base of the blade. The leaf stalk is very long and laterally flattened. Male and female **flowers** grow in elongated, hanging groups known as catkins. The **fruits** are capsules that open when ripe. The cottony masses seen floating through the air are often associated with allergies, as people confuse them with pollen. These usually come from female clones that release them in late spring or early summer, with the cottony cover aiding dispersion by the wind.

ECOLOGY: Requires light along with soils well-supplied with water for development (however, the soil surface should not be permanently covered with water). A minimum soil thickness is required for its development as well (50 cm seems to be a minimum). Tolerates calcareous soils, and dry soils for short periods (i.e., it can withstand short-term hydric stress). Pollution-resistant. In North America, it withstands temperatures down to -35°C. Does not occur in very warm climates with mild winters. Like all species in the willow family, it is not a very long-lived species, although the oldest individuals can reach impressive sizes if they do not become hollow and rotten, which often occurs due to severe pruning or the breaking off of dry branches.

SIMILAR TREES: *Populus nigra, Populus deltoides*



36 *Populus x canadensis* Moench

Canadian poplar

Invasiveness

(potentially) invasive in alluvial forest, risk of introgression

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Prunus cerasifera Ehrh.

37

Cherry plum, Myrobalan plum

Mirabolano

Myrobolan ou Prunier-cerise, Prunier myrobolan ou encore Myrobalan

Kirschpflaume

Mirobalana

37 *Prunus cerasifera* Ehrh.

Cherry plum, Myrobalan plum

Prunus cerasifera Ehrh.

Cherry plum, Myrobalan plum

37

ORIGIN: Native to central Asia, the Balkans, and the Caucasus.

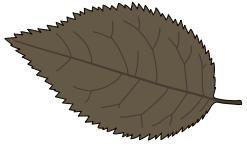
INTRODUCED TO EUROPE: Unknown

OCCURRENCE IN THE ALPINE SPACE: Ornamental plant found mainly in gardens, also escaped cultivation.

MAIN CHARACTERISTICS: A deciduous shrub or small tree reaching 8-10 m in height. It has an erect and bushy habit, with numerous fine and occasionally spiny branches. Young twigs are hairless and glossy. The **bark** is purple-brown, with thin scales and horizontal orange lenticels; it becomes fissured with age. The **leaves** are alternate, elliptical, ovate or obovate, 3-7 x 2-3.5 cm, with crenate saw-toothed margins. They are hairless and glossy above, and hairy on the veins beneath. The **flowers** are hermaphrodite and appear in March-May before the **leaves**. They are usually solitary, 2-2.5 cm wide, on pedicels around 1.5 cm long. The sepals are 2.5-5 mm long with finely glandular saw-toothed margins. The petals are white or occasionally slightly reddish. The **fruits** are 2-3 cm wide, plum-like edible drupes, globose, ripening to red or yellow with a smooth endocarp.

ECOLOGY: Generally prefers the same ecological conditions as in its native range, i.e. well-drained but sufficiently moist, rich, deep soils. Its optimum growth occurs in full sun, though it can tolerate a little shade. It thrives on a wide range of soil types including gravelly, sandy, or nutrient-poor, but not on compacted soils.

SIMILAR TREES: *Prunus insititia*



37 *Prunus cerasifera* Ehrh.

Cherry plum, Myrobalan plum

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Prunus serotina Ehrh.

Black cherry, Dark cherry, Wild black cherry

38

Ciliegio tardivo, Prugnolo tardivo

Cerisier d'automne,
Cerisier noir ou Cerisier tardif

Spätblühende
Traubenkirsche

Pozna čremsa

38 *Prunus serotina* Ehrh.

Black cherry, Dark cherry, Wild black cherry

Prunus serotina Ehrh.

Black cherry, Dark cherry, Wild black cherry

38

ORIGIN: North America

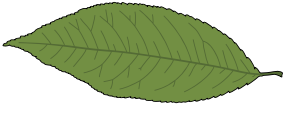
INTRODUCED TO EUROPE: 17th century (1629)

OCCURRENCE IN THE ALPINE SPACE: Parks, gardens, forests; mainly in floodplain and riparian forests. Dispersal speed is higher in open landscapes as well as in managed and disturbed forests (e.g. after thinning) than in natural forests.

MAIN CHARACTERISTICS: A deciduous tree or bush with a round crown and dense, pendulous branches. Leaves do not emerge until late spring; they change colour late in autumn and fall from the tree before winter. The **bark** of young trees is smooth, while older trees have black-brown **bark** with deep furrows breaking into rough plates. Leaves are leathery, dark green and lustrous above; the underside is paler, with dense orange-white pubescence along the mid-rib. The leaf apex is acuminate and the margin is crenate. Flowers are small, white, and borne in narrow, hanging clusters. **Fruits** are round drupes, initially reddish, then purplish-black when ripe. The tree can grow up to 40 m tall in its native region, but barely reaches 20 m outside natural areal.

ECOLOGY: Found on acidic to nearly neutral soils, nitrogen-poor to relatively rich and moderately moist soils. Grows well in temperate and moist climates with mean annual temperatures below 24°C. Can tolerate temperatures above 29°C and down to -40°C. Prefers mean annual rainfall of 1,000 mm and dry seasons lasting no longer than 4 months. Also classified as a stress-tolerant ruderal species. It is an opportunistic, fast-growing tree species with enough shade tolerance to persist in lower canopy positions. It is also a typical gap-phase species that can regenerate in forest understories but needs more light for further growth. Reproduction occurs via **seeds** or vegetatively by sprouting.

SIMILAR TREES: *Prunus padus, Prunus avium, Prunus mahaleb*



38 *Prunus serotina* Ehrh.

Black cherry, Dark cherry, Wild black cherry

Invasiveness

(potentially) invasive in open forests

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Prunus serrulata Lindl.

Japanese cherry

39

Ciliegio giapponese

Cerisier du Japon

Japanische Blütenkirsche, Nelkenkirsche

Japonska češnja

39 *Prunus serrulata* Lindl.

Japanese cherry

Prunus serrulata Lindl.

Japanese cherry

39

ORIGIN: Japan, China, and Korea

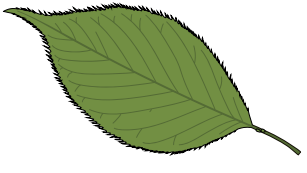
INTRODUCED TO EUROPE: 18th century

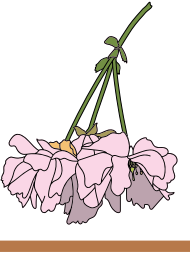
OCCURRENCE IN THE ALPINE SPACE: Parks, gardens

MAIN CHARACTERISTICS: A medium-sized deciduous tree with a single trunk and dense crown. It is characterized by rapid growth and usually reaches heights of around 5-10 m, with a maximum of 25 m. The brown **bark** is smooth with prominent horizontal lenticels. Its green **leaves** are arranged alternatingly and are ovate to lanceolate, with a serrate or doubly serrate margin. The **flowers** are white to pink with five petals, and are produced in clusters of two to five in spring at the same time when the new **leaves** appear.

ECOLOGY: Needs good drainage. It grows best in moist, fertile, well-drained humus loams and clays in full sun or partial shade. Best flowering is achieved in full sun.

SIMILAR TREES: *Prunus sargentii, Prunus avium, Prunus subhirtella*





39 *Prunus serrulata* Lindl.

Japanese cherry

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Pseudotsuga menziesii (Mirb.) Franco

Douglas-fir

40

Abete di Douglas, Douglasia

Sapin de Douglas, Pin de l'Orégon

Douglasie

Navadna ameriška duglazija

40 *Pseudotsuga menziesii* (Mirb.) Franco

Douglas-fir

Pseudotsuga menziesii (Mirb.) Franco

Douglas-fir

40

ORIGIN: Western North America, south-western Canada

INTRODUCED TO EUROPE: 1872

OCCURRENCE IN THE ALPINE SPACE: Forests, parks

MAIN CHARACTERISTICS: A straight-trunked coniferous tree with the capacity to grow to over 90 m in height. The **bark** is characterized as reddish-brown with deep, thick grooves. The **leaves** are flat, soft, linear, 2-4 cm long and generally resemble those of the firs. They grow singly rather than in fascicles and completely encircle the branches, which can be useful for recognizing the species. They also smell of citrus fruits. The female **cones** are pendulous with persistent scales, unlike those of true firs. They are distinctive in having a long, tridentate (three-pointed) bract protruding prominently above each scale.

ECOLOGY: Grows on different soil types but performs best on deep, base-poor, fresh to moist, well-drained and moderately acidic soils with a pH range from 5 to 6. It is considered a moderately shade-tolerant tree species that is more light-demanding than e.g. silver fir (*Abies alba*) or Norway spruce (*Picea abies*). It can tolerate water shortages but does not grow on periodically wet sites. Highly sensitive to drought during the germination period and early establishment stage, but able to adjust well to extreme droughts once successfully established.

SIMILAR TREES: *Picea abies*

40 *Pseudotsuga menziesii* (Mirb.) Franco

Douglas-fir

Invasiveness

(potentially) invasive in open forests and rocky areas

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Quercus coccinea Münchh.

41

Scarlet oak

Quercia scarlatta

Chêne écarlate

Scharlach-Eiche

Škrlatni hrast

41 *Quercus coccinea* Münchh.

Scarlet oak

Quercus coccinea Münchh.

Scarlet oak

41

ORIGIN: Eastern United States (Maine, Wisconsin) and southern Canada

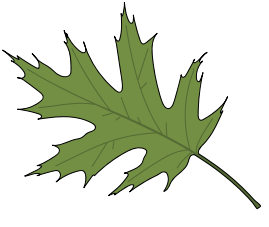
INTRODUCED TO EUROPE: 19th century

OCCURRENCE IN THE ALPINE SPACE: Mainly parks and gardens

MAIN CHARACTERISTICS: This medium to large deciduous tree with an open, rounded crown can reach 20-30 metres in height. The **bark** of young trees is characterized by irregular ridges separated by shallow fissures of varying width. Eventually, the bark on the lower trunk becomes dark brown to nearly black. The tree is often confused with the American red oak, and its lumber products are sold as "red oak lumber". Its lobed **leaves** are green (later red, purple, or bronze), shiny, 7-17 cm long and 8-13 cm wide. Each lobe has three to seven small teeth. The acorns are ovoid, 7-13 mm wide and 17-31 mm long. The cup covers the acorn over a third to half of its length. Initially green, the fruit turns light brown around 18 months after pollination. The inside of the acorn is very bitter.

ECOLOGY: Prefers full sun as well as dry, sandy, and usually acidic soils. Although its successional position has not been defined, scarlet oak is probably a climax tree on dry soils. Because of its hardiness, it can be planted on a wide variety of soils.

SIMILAR TREES: *Quercus palustris, Quercus rubra*



41 *Quercus coccinea* Münchh.

Scarlet oak

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Quercus rubra L.

Red oak

42

Quercia rossa

Chêne rouge d'Amérique

Roteiche

Rdeči hrast

42 *Quercus rubra* L.

Red oak

Quercus rubra L.

Red oak

42

ORIGIN: Eastern USA and the adjoining southeast of Canada

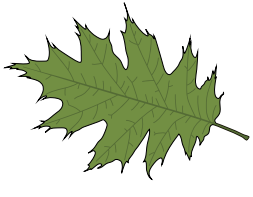
INTRODUCED TO EUROPE: Switzerland, 1691

OCCURRENCE IN THE ALPINE SPACE: Planted in parks, gardens, and forests

MAIN CHARACTERISTICS: The northern red oak is a deciduous tree that grows to heights of 20-25 m and has a round crown. It can live up to 400 years and reaches a trunk diameter of up to 2 m. The **bark** is grey and smooth respectively thinly scaled when older. The alternate and spirally arranged **leaves** on the branches are up to 23 cm long and pointed. The fresh leaf shoots are yellow for the first three weeks; after that, the leaves turn green and become bright red to orange in autumn, or sometimes yellow to brown on older trees. The male inflorescences hang down loosely and are yellowish-green. The female **flowers** grow singly or in pairs. The broad, egg-shaped acorns only ripen in the second year and are about 2 cm long and thick.

ECOLOGY: Grows on dry to moderately moist slopes and well to poorly drained uplands. It typically grows on clay, loam, and sandy or gravelly soils. Best growth is in full sun and on well-drained, slightly acidic, sandy loam. It is periodically shade tolerant, particularly up to the age of 10 years, and can therefore persist below a dense canopy for a certain period. In the Alpine space, successful spread and establishment only occurs in isolated cases on nutrient-poor, dry soils with little browsing pressure.

SIMILAR TREES: *Quercus palustris, Quercus coccinea, Quercus cerris*



42 *Quercus rubra* L.

Red oak

Invasiveness

(potentially) invasive in open forests and rocky areas

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Quercus suber L.

Cork oak

43

Quercia da sughero

Chêne liège

Korkeiche

Plutovec

43 *Quercus suber* L.

Cork oak

Quercus suber L.

Cork oak

43

ORIGIN: Western Mediterranean and along the southern part of the Atlantic coast

INTRODUCED TO EUROPE: Native to the European Mediterranean coast

OCCURRENCE IN THE ALPINE SPACE: Rarely, as an ornamental tree only

MAIN CHARACTERISTICS: Can grow to a height of 15 m. Its **bark** is spongy-suberous, very thick and cracked, with grey tomentose ramules. The **leaves** are tough and persist for 2 years. They are stalked, oval or oblong, toothed and spiny or almost whole, green above, whitish and tomentose below, with 10 to 14 secondary veins. **Fruits** are almost stalkless on the year's branches. The cup has a greyish colour and is conical at the base, with slightly protruding scales, the upper ones being longer and erect. The acorn features a short, hairy tip.

ECOLOGY: A calcifuge, heliophilous and thermophilic species that thrives in temperate climates with mild winters. It can withstand very cold temperatures. The ecological plasticity of cork oak with regard to annual rainfall is high; it exhibits good growth when between 800 and 1200 mm. It seeds and thrives best in open orchard stands.

SIMILAR TREES: *Quercus ilex*

43 *Quercus suber* L.

Cork oak

Invasiveness

Not considered invasive

Occurrence

Drought tolerance (*)

Frost tolerance

Shade tolerance (*)

Waterlogging tolerance (*)

Allergic potential

(*) Data not available for this species

Rhus typhina L.

Staghorn sumac

44

Sommaco americano

Sumac vinaigrier

Essigbaum

Octovec

44 *Rhus typhina* L.

Staghorn sumac

Rhus typhina L.

Staghorn sumac

44

ORIGIN: North America

INTRODUCED TO EUROPE: 1629

OCCURRENCE IN THE ALPINE SPACE: An extremely widespread ornamental plant that grows wild in some places like forest edges, clearings, scrubland, waste ground, abandoned fields, and gardens.

MAIN CHARACTERISTICS: A small tree or shrub growing to a height of 5-7 m, with a wide, spreading, open crown. Leaves are large and pinnately compound, with 13-27 lanceolate leaflets featuring serrate margins. The leaflets are bright green above and silvery below. When torn, they exude a pale milky sap. Leaflets, twigs, and young branches are covered with fine hairs. Flowers are small, greenish-yellow, and borne in upright clusters. **Fruits** are fuzzy and red, and grow in upright, conical, dense clusters that remain on the tree until the following spring. The pale yellowish-green **flowering** clusters on male plants can reach about 30 cm in length. They are much bigger than the greener and more compact clusters of **flowers** on female plants.

ECOLOGY: Generally prefers fertile upland sites, but can tolerate a wide variety of ecological conditions. Undemanding tree that grows well on different soils, including slightly acid conditions and textures ranging from coarse to fine. Grows best on rich, warm, south-facing sites. Trees can thrive on nutrient-poor, rocky soils as well as dry or salty soils. It avoids overly wet, cold, or acidic environments, but can survive cold winter temperatures and in urban surroundings. It is a light-demanding tree and considered an early successional species. It also thrives in polluted city air and can grow in ruderal sites as well as in cracks in the pavement.

SIMILAR TREES: *Ailanthus altissima, Rhus copallinum, Rhus glabr*a

44 *Rhus typhina* L.

Staghorn sumac

Invasiveness

(potentially) invasive in open areas

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Robinia pseudoacacia L.

45

Black locust

Robinia, Acacia

Robinier faux-acacia

Robinie, Scheinakazie

Navadna robinija
(neprava akacija)

45 *Robinia pseudoacacia* L.

Black locust

Robinia pseudoacacia L.

Black locust

45

ORIGIN: North America

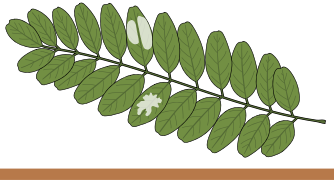
INTRODUCED TO EUROPE: 1600

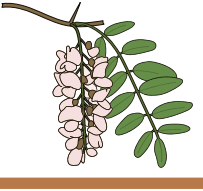
OCCURRENCE IN THE ALPINE SPACE: Along roads or railroads, agricultural areas, wastelands, quarries, and embankments. It has also naturalized in mountain and lowland forests, meadows, and riverbanks.

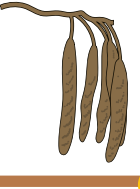
MAIN CHARACTERISTICS: Can reach a height of 30 m and almost 1 m in diameter. Height growth is rapid. Identification is generally easy thanks to its very cracked **bark**, the spines, **leaves**, and **flowers**, and the distinctive shape. Has a shallow, aggressive root system. The **bark** is deeply furrowed and dark reddish-brown to black. The tree has an alternate branching pattern that creates a zigzag effect. A pair of sharp, stout, 1-2 cm long thorns grows at each node. The pinnately compound **leaves** are 3-6 cm long, with 7-19 short-stalked leaflets that are dull green in colour, ovoid or oval, 0.5-1 cm long, thin, scabrous above and pale below. The separate male and female plants have sweetly fragrant **flowers** that are creamy white with five petals (bean-like) arranged in a pyramidal spike. They usually bloom in May or June. The legume-like **seeds** are produced in a flat brown or black pod that is 1-2 cm long.

ECOLOGY: This tree is a pioneer tree species that grows under a wide range of edaphic and climatic conditions and does better in non-native areas than in its native areas. It thrives best on light, deep, and fertile sandy soils. It is sensitive to wind, snow, and very low temperatures, and does not tolerate shade. Black locust reproduces both sexually via flowers and asexually via root suckers.

SIMILAR TREES: *Amorpha fruticosa, Styphnolobium japonicum*







45 *Robinia pseudoacacia* L.

Black locust

Invasiveness

(potentially) invasive in open areas, open forests, and open riparian forests

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Styphnolobium japonicum

(L.) Schott.

Japanese pagoda tree

46

Acacia giapponese

Sophora du Japon

Japanischer Schnurbaum

Japonska sofora, pagodovec

46 *Styphnolobium japonicum*

(L.) Schott.

Japanese pagoda tree

Styphnolobium japonicum

(L.) Schott.

Japanese pagoda tree

46

ORIGIN: Central, northern, and north-western China and Korea

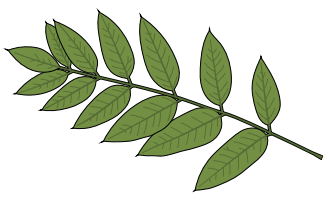
INTRODUCED TO EUROPE: **Seeds** brought to Europe in 1753, planted in 1762 (Kew Gardens, London)

OCCURRENCE IN THE ALPINE SPACE: Widely used as an ornamental plant in many parks, gardens and along streets.

MAIN CHARACTERISTICS: Can grow up to 20-30 m high and has a broad, spherical crown. The **bark** is brown and very cracked. Young branches are greenish up to their third year. The **leaves** are alternate and composed of 3-10 pairs of mostly opposite pinnate leaflets along with a terminal leaflet (unpaired pinnate). The leaflets are 3-7 cm long and 2-3 cm wide, ovate, elongated, and taper at the tip, with a fine downy feather. The underside is bluish-green. The cream-coloured, sometimes pink **flowers** are borne in very large groups in the middle of summer. All stamens (the male part of the flower) are free. The **fruits** are cylindrical, 3-7 cm long and 0.9-1.5 cm wide. Furthermore, they are uncut, meaning they do not split when ripe. This distinguishes it from true *acacia* (genus *Acacia*), black locust (*Robinia pseudoacacia*), and honey locust (*Gleditsia triacanthos*).

ECOLOGY: Prefers a sunny, open location on any light soil. Optimal conditions are fresh, deep, and rich soils. It tolerates salty soils, polluted air, and strong winds.

SIMILAR TREES: *Robinia pseudoacacia, Cladrastis lutea, Gleditsia triacanthos, Acacia* sp.



46 *Styphnolobium japonicum*

(L.) Schott.

Japanese pagoda tree

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Thuja occidentalis (L.)

Northern white cedar

47

Tuia

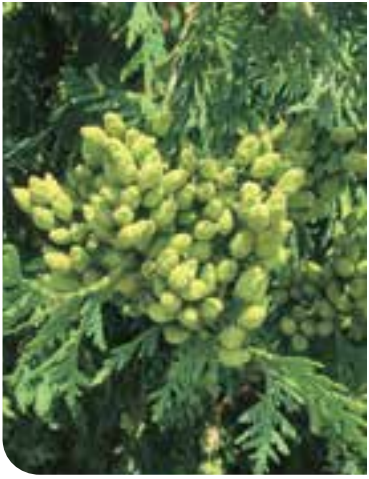
Thuya occidental

Abendländischer Lebensbaum

Ameriški klek

47 *Thuja occidentalis* (L.)

Northern white cedar



Thuja occidentalis (L.)

Northern white cedar

47

ORIGIN: Southern Canada and northern United States

INTRODUCED TO EUROPE: 1536

OCCURRENCE IN THE ALPINE SPACE: Mainly found in parks, private gardens, and cemeteries. Due to its evergreen **leaves**, it is very popular as a hedge. It occurs in all countries associated with the Alpine region.

MAIN CHARACTERISTICS: A monoecious tree related to family Cupressaceae. Trees usually occur with a single trunk of up to 100 cm in diameter and a conical crown of about 15-20 m height. The **bark** is brown-red, 6-9 mm thick, and fissured into narrow ridges covered with elongated scales. The **leaves** are evergreen, 1-4 mm long and 1-2 mm wide, bright green above and pale green below, opposite and scale-like. The **seeds** are brown-red and have a length of 4-7 mm (including the wings). The **seed cones** are ovate, 8-14 mm long and green. At maturity, they turn brown with two pairs of lignified fertile scales.

ECOLOGY: In its native range, the northern white cedar grows mainly on nutrient-rich, sandy soils in regions with cool summers and a short growing season. It is particularly common in coniferous swamps or on calcareous mineral soils, where competition from other fast-growing and higher species is low. Because of its shallow root system, it is quite vulnerable to windthrow.

SIMILAR TREES: *Thuja plicata, Thuja orientalis, Chamaecyparis lawsoniana*

47 *Thuja occidentalis* (L.)

Northern white cedar

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Tsuga canadensis (L.) Carr.

Eastern hemlock

48

Tsuga

Pruche du Canada, Pruche de l'Est

Kanadische Hemlocktanne

Kanadska čuga

48 *Tsuga canadensis* (L.) Carr.

Eastern hemlock

Tsuga canadensis (L.) Carr.

Eastern hemlock

48

ORIGIN: North-eastern United States and south-eastern Canada

INTRODUCED TO EUROPE: 1736

OCCURRENCE IN THE ALPINE SPACE: A common ornamental tree in Europe, often present in parks.

MAIN CHARACTERISTICS: A dense, pyramidal conifer of the *Pinaceae* family that can grow up to 30 m high. The species is known for having the smallest **needles** and **cones** in the genus. The ends of the branches droop, and lower branches often dip towards the ground, which causes bulging wood. The root system is shallow and widely spread. The **bark** of mature trees is thick and ridged, with a red-brown to grey-brown colour. Short, dark green **needles**, finely sawed at the edges with two white bands beneath, are arranged in two opposite rows and attached to the twigs by slender stalks. The small, pendant, short-stalked, seed-bearing **cones** are tan in colour.

ECOLOGY: In its natural range, the eastern hemlock's ecological characteristics include a high degree of shade tolerance related to its crown architecture, light saturation properties, and root/shoot development rates at low light levels. The tree can regenerate naturally on seedbeds consisting of well-decomposed litter, rotted wood, or moss mats, but reproduces poorly on undisturbed hardwood litter. Established seedlings respond well to moderate release in terms of diameter and height growth but are negatively affected by overexposure. Thrives in cold, fresh, moderately moist sites.

SIMILAR TREES: *Tsuga heterophylla, Tsuga sieboldii*

48

Tsuga canadensis (L.) Carr.

Eastern hemlock

Invasiveness

Not considered invasive

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

Ulmus pumila L.

Dwarf elm

49

Olmo siberiano

orme nain de Sibérie

Sibirische Ulme, Zwergulme

Sibirski brest

49 *Ulmus pumila* L.

Dwarf elm

Ulmus pumila L.

Dwarf elm

49

ORIGIN: North and East Asia (China, Mongolia, Korea, and Asian part of the Russian Federation)

INTRODUCED TO EUROPE: 16th century

OCCURRENCE IN THE ALPINE SPACE: Parks, roads, avenues. In the 20th century, the species was widely planted in Europe owing to its resistance to Dutch elm disease.

MAIN CHARACTERISTICS: A medium-sized, deciduous tree with a broad, pyramidal crown. Usually grows to 8-12 m in height but can reach 15 m in ideal circumstances. The trunk usually divides into several large ascending branches that eventually subdivide into smaller branches and very abundant slender twigs. The **bark** of mature trees is light grey to grey, rough-textured, and irregularly furrowed with fragmented ridges. Small, alternate **leaves** occur along the twigs and shoots; they are 3-8 cm long and 0.8-3 cm wide, elliptic to oblong-lanceolate, and serrate along their margins. The upper leaf surface is medium to dark green and glabrous, while the lower surface is pale green and hairless or with short hairs along the major veins. Flowers are joined in clusters of 3 to 15, they are green and inconspicuous. **Fruits** are light green, oval-orbicular, flattened samaras with a single **seed** in the centre.

ECOLOGY: The Siberian elm prefers fertile, well-drained soils with abundant sun, yet it is also extremely adaptable to harsh conditions such as drought, cold winters, long floods, and poor, dry soils. It cannot tolerate very acidic soils, however. As with other elm species, it can grow in areas with pollution and salinity. It settles early in the season, grows fast, and rapidly re-sprouts from its roots, which makes it very competitive and even invasive in some countries. It is resistant to Dutch elm disease, which is often fatal to other elms, as well as to frost. It is prone to damage from wind, snow, and especially ice, causing breakage of branches and twigs that litter the ground underneath the tree. Its upper distribution limits range from 1,700 m in the north to 2,500 m above sea level in the south.

SIMILAR TREES: *Ulmus minor, Ulmus parvifolia, Ulmus japonica*

49 *Ulmus pumila* L.

Dwarf elm

Invasiveness

risk of introgression

Occurrence

Drought tolerance

Frost tolerance

Shade tolerance

Waterlogging tolerance

Allergic potential

IMPRESSUM

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If this book has awakened your interest in non native tree species in the Alpine Space, you can find more in-depth information in our full-scale handbooks

- Non native Tree Species in the Urban environment in the Alpine Space
- Non native Tree Species in Forests in the Alpine Space

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