Quercus pubescens

Quercus pubescens in Europe: distribution, habitat, usage and threats

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Quercus pubescens Willd., the downy or pubescent oak, is a middle-sized deciduous or semi-deciduous tree. Frequent hybridisation with other oaks, the complex sequence of survival and migration events during Pleistocene glaciations and the fragmentation of its populations due to long-lasting human impact are responsible for the remarkable variability of downy oaks. They have a wide distribution range, occupying almost all of central and southern Europe from western Spain to Ukraine and Anatolia with some isolated populations in the Caucasian area. Downy oaks are able to stand both moderate summer drought stress and low winter temperatures. On the other hand, they are poor re-sprouters and fare badly after intense anthropogenic disturbance. Forests dominated by this oak are quite common in southern Europe, while they are confined to warm microclimatic conditions in central Europe. Its wood is mainly used as firewood. Downy oaks are among the most frequent hosts of all the economically important truffles.

Quercus pubescens Willd., known as downy or pubescent oak, is a middle-sized (15-20 m, rarely 25 m tall) deciduous or semi-deciduous tree. Its alternate leaves are mostly ovate-oblongate, (3)/5-10 cm long bear a short petiole (5 to 20 mm), with 5-6 more or less deep lobes. Leaves are densely pubescent (the reason for its common names) and green-grey when they start developing, soon after all the hairs of their upper side fall down and leaves become leafy and dark green. Male flowers have 6-10 stamens and are grouped to form pubescent catkins which grow up along with new leaves at the base of new shoots. The short stalked female flowers have greenish stigmas and develop on the axil of distal leaves. The fruits - often grouped in clusters of 3-4 acorns - have a short hairy petiole, are mostly elliptic (2-5.5 cm long) and enclosed for ¼ to ⅔ of their total length by cupules which are covered by imbricate triangular hairy scales. Flowering season (from March to May) varies along with altitude. The huge acorns ripen from September to November and are able to germinate immediately and to develop vigorous roots in very short time. The bark of downy oaks is characterised by deep furrows and rough and thick plates which represent an effective protection against grazing fires.

Distribution

Species concept is particularly hard to be applied to downy oak, primarily because of frequent hybridisation with other sympatric deciduous oaks such as Pyrenean oak (Quercus pyrenaica) and Portuguese oak (Quercus faginea), sessile oak (Quercus petraea) and Hungarian oak (Quercus frainetto), secondly the complex history of its climate-driven survival and migration during Pleistocene glaciations, and finally the fragmentation and isolation of its populations due to millennia of deforestation. These counteracting mechanisms (hybridisation vs. inbreeding and genetic drift due to habitat fragmentation) explain most of the high morphological variability of its populations. Hence, many eco-morphotypes living in South European peninsulas and/or in the main Mediterranean islands are treated as narrow endemics, like Quercus virginiana (incl. Quercus ampeloptica) reported for the Balkan-Pontian area, Sicily and South Italy, Quercus brochypodphylo for South Greece, Crete and South-western Anatolia, Quercus pubescens subsp. crispata (syn. subsp. atotolica) for central and Western Anatolia and with a few isolated populations in the Caucasian area (Daghhestan, Georgia and Azerbaijan), Quercus congesto (incl. Quercus leptobolos) for Sardinia, Sicily and South Italy, Quercus dealchichymi for South Italy, and Quercus schneiderei for Sardinia. Only rigorous statistical methods applied to morphological traits make it possible to distinguish some of these taxa, while genetic analyses still fail to point out any clear differences among them. Supported also by the most authoritative key to European oaks, all the above mentioned species and sub-species are clumped within a single species. In this way Quercus pubescens sensu lato has a wide range occurring almost all central and southern Europe from Western Spain to Ukraine and Anatolia with a few isolated populations to the Balkan area, Black Sea and Caucasus. Considering its wide ecological niche it is possible that downy oak woods covered very extensive surfaces all over Europe before being destroyed to make room for cereal fields, vineyards and olive groves.

Habitat and Ecology

Downy oaks show a very wide altitudinal range, especially in the southern countries. Although they are more common on hillsides between 200 and 800 m, they grow from coastal plains up to 1 200-1 300 m. Indifferent to pH, they prefer lime-rich and well drained soils in the northern part of their range, while they may also be common on acidic soils in the warmer countries (e.g. Sicily and Crete). It behaves as a heliophilous and thermophilous species and is perfectly adapted to stand both moderate summer drought stress and low winter temperatures, although avoiding continental locations subject to most frequent frost and/or drought events. As this oak is a very poor re-sprouter, it may be outcompeted by more resilient tree species under intense and frequent anthropogenic disturbance regimes (e.g. cutting, wildfires, overgrazing, etc.). On the other hand, it may perform rapid colonisation through seed dispersal after disturbance removal. Quercus pubescens-dominated forests are quite common in South Europe, while they are confined to warm microclimatic conditions in central Europe. Vegetation surveys concerning these communities are available for Germany, Bulgaria, Czech Republic, Italy, Austria, Slovakia, Hungary, Greece and former Yugoslavia. Downy oaks often co-occur with other deciduous trees of South-Eastern Europe and South-Western Asia, such as Oriental hornbeam (Carpinus orientalis), nettle trees (Celtis spp.), marina ash (Fraxinus ornus) and hop hornbeam (Ostrya carpinifolia). A West-East gradient in the composition of species-assemblages has been recorded in the Balkan Peninsula, while evergreen species cover and diversity values increase significantly along a North-South gradient in the Italian Peninsula. Several authors classify downy oak forests in the vegetation communities at the level of order (Quercetalia pubescens) within the class...
Quercus pubescens

Quercus-Fagetum (European temperate summer-green deciduous forests) while other species prefer to treat them as a separate class (Quercus pubescens) which actually put down oak woods in sub-Mediterranean contexts. On Mediterranean islands the downy oak often co-occurs with holm oak (Quercus ilicis) and cork oak (Quercus suber) (Sicara, Cardinale and Sicula) or even with kermes oak (Quercus cocifera) (Cortes). As the undergrowth of insular evergreen forest communities, most of them have been included within the class Quercetalia pubescentis. On the other hand, ongoing monitoring activities on forest dynamics suggest that the cessation or reduction of disturbance may allow downy oaks to become the dominant species of final Northern Mediterranean forest communities, outpacing Quercus ilex which will be confined to more disturbed places on shallow and poor soils.

Importance and Usage

Most pure downy oak forests cover 8760 and 8500 km² in France and Italy, respectively. Notwithstanding the lack of quantitative data, pure and mixed stands are also very common in Balkan countries. Due to its irregular fibrous structure and the crookedness of the trunks, the wood of downy oak is scarcely considered as industrial timber and it is mainly used as firewood. In the past, it was largely employed for railway sleepers, while nowadays it is occasionally used for carpentry, boat-building, or packaging. Downy oaks are among the most frequent hosts of all the economically important truffles (Tuber aestivum, T. macroporus, T. magnatum, T. melanosporum, T. uncinatum). Considering the remarkable increase of tree ring experience by the downy oak in response to the increase of atmospheric CO2 during the last century, its increased use in Southern European afforestations could be a very effective tool of atmospheric CO2 sequestration.

Threats and Diseases

Several species of Gymnoscelis belong to the genus Phytophthora are responsible for the so-called ‘oak decline’ which affects downy oak forests more and more frequently, especially those of the Mediterranean countries which are subjected to more severe climatic stress and increasing frequency of climatic anomalies such as extreme drought or strong shifts in seasonal rainfall distribution. In particular, downy oak is susceptible to Phytophthora cinnamomi, Phytophthora ramorum and highly vulnerable to Phytophthora quercina. The tree may also be attacked by the gypsy moth (Lymantria dispar) which has the potential to expand its virulence, due to climate change, in the European temperate oceano-continental zones.

References


Unknown, no data
Tundra, cold desert
Negligible survivability
Low survivability
Mid-low survivability
Medium survival
High survivability

Map 5: High resolution map estimating the maximum habitat suitability.

Tree species
European Atlas of Forest Tree Species

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