

TREES FOR BEES CORNER

STAR PERFORMERS PART 13: THE MIGHTY OAK

Dr Linda Newstrom-Lloyd (*Trees for Bees Botanist*), Dr Angus McPherson (*Trees for Bees Farm Planting Adviser*), and Jean-Noël Galliot (*Trees for Bees student intern*)

Trees for Bees has produced a series of fact sheets showcasing the 'best of the best' bee plants that will maximise nutritional benefits for your bees. In this issue of the journal, the team explains why the English oak is a 'star performer'. For more information, see www.treesforbeesnz.org.



Figure 1. *Trees for Bees* botanist, Linda Newstrom-Lloyd, under a large English oak tree at Eastwoodhill National Arboretum in Gisborne.

The English oak, *Quercus robur*, grows into a huge and wide-spreading tree with enormous amounts of pollen in the springtime. In a mature flowering oak, the abundance of pollen can attract thousands of bees.

The mighty oaks are the most impressive star performers when they reach flowering maturity. Their wide-spreading branches and tall height (up to 30+ metres), means that these oak trees deliver pollen like no other—especially in terms of pollen volume per square metre of footprint on the ground.

The oaks, along with beech trees, belong to the beech family, Fagaceae. There are about 600 species of oaks globally while four oak species are listed as commonly cultivated

and naturalised in New Zealand (Webb, Sykes & Garnock-Jones, 1988). However, Salmon (1999) lists about 38 oak species and there are far more in Eastwoodhill National Arboretum and Hackfalls Arboretum in Gisborne.

Oaks are evergreen or deciduous and range from large trees to small, but the most widely planted in New Zealand is the majestic English oak, *Quercus robur*, also called the common oak or the pedunculate oak (Salmon, 1999).

Our surprise

The English oak was the first mighty oak that we came across in our *Trees for Bees* field work. In 2012, our student intern, Jean-Noël Galliot (from Agro-Campus Ouest, Rennes, France), discovered honey bees foraging in a huge oak tree at Eastwoodhill National Arboretum, Gisborne. No one at the arboretum had spotted this before.

When Jean-Noël first heard that bee buzzing sound near a big oak tree, he was convinced the bees were in the tree, but no one believed him. The honey bees were hard to see so high up in the canopy. His eyes were sharp, and he was skilled at netting bees with a four-metre-long insect net, so he was able to capture the bees to prove that the bees were collecting oak pollen in the tree.

When we reported oaks as a good bee tree, many beekeepers were doubtful because they had never noticed it either. It is difficult to detect bees in oak flowers because the bee coloration is similar to oak male catkins when they are shedding pollen—so the bees blend in. The sheer size of a mature English oak tree compared to a human is another reason why bees foraging may go unnoticed (Figure 1). The flowers are tiny and very high in the canopy, and besides, many oak trees do not flower every year.

Flowers

In New Zealand, English oaks flower in spring in September and October (Webb et al., 1988). The fruiting and flowering patterns of English oak have been well studied to understand the ecological factors influencing the alternate or biennial bearing of acorn crops (e.g., Crawley & Long, 1995), and to understand the biennial patterns of peak pollen production for predicting pollen allergy seasons (e.g., Rodríguez-Rajo, Méndez & Jato, 2005).

The English oak is a typical wind-pollinated, deciduous, north temperate zone tree that has male and female flowers separated on the same tree. The separation of the male and female functions into different flowers on the same tree allows the specialisation of the two types of flowers needed for pollen dispersal (male flowers on catkins releasing pollen to the wind) and pollen capture (female flowers exposed on terminal branches to catch pollen in their feathery branched stigmas).

Pollen

Large English oak trees produce a lot of pollen. The quantity and density of male catkins and the amount of pollen produced per flower results in copious pollen spread by wind (Figure 2). This is typical of wind-pollinated deciduous trees such as the alders and walnuts, as described in previous articles in *The New Zealand BeeKeeper* (Newstrom & McPherson, 2020a and 2020b).

If we were to calculate the height and width of an English oak tree canopy as well as the depth and density of the flowers in the canopy, we would find a staggering number of male catkins on just one tree. One such calculation was made on English oak trees in Spain, showing that the average number of male catkins produced per year on one mature tree was around 330,000 catkins (Illán, 2003; cited by Rodríguez-Rajo et al., 2005).

continued...

References

- Crawley, M. J., & Long, C. R. (1995). Alternate bearing, predator satiation and seedling recruitment in *Quercus robur* L. *Journal of Ecology*, 83, 683–696.
- Gardenia (n.d.). *Quercus robur* (English oak). Retrieved July 14, 2020 from <https://www.gardenia.net/plant/quercus-robur>
- Illán, C. (2003). Estudio fenológico del carballo (*Quercus robur*) en Ourense. Agricultural Engineering Degree Project. Vigo, Spain: University of Vigo (in Spanish).
- Jerković, I., & Marijanović, Z. (2010). Oak (*Quercus frainetto* Ten.). Honeydew Honey—approach to screening of volatile organic composition and antioxidant capacity (DPPH and FRAP Assay). *Molecules*, 15, 3774–3756. <https://doi.org/10.3390/molecules15053744>
- Kew Science: Plants of the World Online. (n.d.) *Quercus robur* L. Retrieved July 12, 2020 from <http://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:304293-2>
- Missouri Botanic Garden. (n.d.). Plant Finder *Quercus robur*. Retrieved July 12, 2020 from <http://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?taxonid=280706>
- Newstrom-Lloyd, L., & McPherson, A. (2020a). Star performers part 11: Autumn flowering alder trees. *The New Zealand BeeKeeper*, 28(3), 34–36.
- Newstrom-Lloyd, L., & McPherson, A. (2020b). Star performers part 12: Wonderful walnut pollen in spring. *The New Zealand BeeKeeper*, 28(5), 14–16.
- Parton, K., & Bruere, A. N. (2002). Plant poisoning of livestock in New Zealand. *New Zealand Veterinary Journal*, 50(sup3), 22–27. <https://doi.org/10.1080/00480169.2002.36262>
- Rodríguez-Rajo, F. J., Méndez, J., & Jato, V. (2005). Factors affecting pollination ecology of *Quercus* anemophilous species in north-west Spain. *Botanical Journal of the Linnean Society*, 149, 283–297. <https://doi.org/10.1111/j.1095-8339.2005.00460.x>
- Salmon, J. T. (1999). *The Trees in New Zealand: Exotic Trees, The Broadleaves* (pp. 60–62). Auckland, New Zealand: Reed Books.
- Webb, C. J., Sykes, W. R., & Garnock-Jones, P. J. (1988). *Flora of New Zealand. Volume IV. Naturalised Pteridophytes, Gymnosperms, Dicotyledons* (p. 712). Botany Division, Department of Scientific and Industrial Research, Christchurch, New Zealand.



Figure 2. Upper crown of the English oak tree (*Quercus robur*) in bloom with thousands of male catkins swaying in the wind.



Figure 3. Branches of English oak tree (*Quercus robur*) viewed from the underside, showing dense grouping of male catkins mixed in with the leaves. Note arrow pointing to a bee with huge pollen loads approaching the catkins.

The male flowers and the leaves open at the same time, which is another reason why it is hard to see the bees foraging for pollen in the canopy (see the arrow in Figure 3 pointing to a bee approaching a male catkin). The best way to see if bees are collecting pollen in an oak tree is to try to see them when they are in flight approaching the male catkins, as they are more visible than when they have already landed on the catkin and blended in.

The elongated and pendulous male catkins are about 3 to 9 cm long (Webb et al., 1988). The male catkin in Figure 4 shows that each of the many male flowers along the catkin stalk has a cluster of from three to nine stamens (Webb et al., 1988). Male flowers do not have petals or anything else to get in the way of dispersing pollen to the wind. Since the bees have a good landing platform along the catkin stalk, they can rapidly collect generous oak pollen loads. The pollen has good protein content at around 19% (Trees for Bees NZ, unpublished data).

Nectar

Like other wind-pollinated trees in this group of northern hemisphere spring-flowering

trees (the Fagales group), there is no nectar. The flowers are designed for wind pollination, so they do not need nectar to attract insects for pollination. Of course, that does not stop honey bees from visiting to take advantage of the copious pollen freely available and easy to access.

When 'oak honey' is referred to it is not nectar honey from the flowers; it is most likely honey dew from insects on the oak tree and should be called Oak Honeydew Honey rather than Oak Honey (Jerković & Marijanović, 2010).

Multiple uses

English oak is a premier timber species, used in construction, joinery, and furniture. However, as with many specialty timber species in New Zealand, the market is limited, with most oak trees established for amenity purposes.

Acorns can be toxic to animals so care will need to be taken establishing oaks around livestock, especially cattle and sheep but sometimes deer and also pigs, dogs, and horses (Parton & Bruere, 2002). Although all acorns are toxic, the effect on the animal will depend on the dose, in other words the proportion of their diet and the size of the animal. The most dangerous acorns are those that are brought down after a storm, which are probably immature green acorns.

In general, many farms in New Zealand have animals grazing near oak trees, but if they are eating a lot of grass and other plants this could mitigate the effect of eating some acorns. It is important to consult local farmers and veterinarians about any toxicity issues with English oak in your area. In contrast, in Spain pigs do forage on acorns of the Holm and cork oak species and some of the world's best ham comes from pigs finished on acorns ("Jamón Ibérico de bellota": see <https://www.jamon.com/about-jamon-iberico.html>).

Planting advice

English oaks have been used on a number of Trees for Bees demonstration farms, from single specimen trees through to avenues, shelterbelts and amenity planting. While relatively slow growing, they do grow to a large size and are very long-lived; so they provide an excellent long-term source of spring pollen for bees. The spreading tree form of English oak tends to be used as specimen trees and in avenues where there is sufficient space, and the upright form (*Q. robur* v. *fastigiata*) works well in shelterbelts and avenues.

The English oak tends to grow best on moist, well-drained loams (Missouri Botanical Gardens, n.d.) in full sun but will tolerate a wide range of soil types and pH and will tolerate drought. They can grow to 15 to 25 m in height and occasionally up to 45 m high (Kew Science: Plants of the World Online, n.d.). Therefore, it is recommended that they be given enough space to grow into.

For the spreading English oak, suggested final spacing is 15 m to 25 m between trees, although you may wish to plant closer together initially and then select the best specimens later. For the fastigiata form, which grows to 18 to 20 m+ tall and 3 to 5 m wide, trees can be spaced 6 to 10 m apart, depending on how wide-spaced you want your avenue or tall shelter trees to be.

As with all specimen trees, small-grade trees may only require a single stake and a tree guard if there are pests or stock around, whereas larger-grade trees may require larger stake(s).

The English oak is a prolific producer of acorns starting from about age 5 to 10 years in New Zealand, according to some reports (Chris Ryan, pers. comm.). In North America and Europe, much longer ages to the first acorn crop have been reported; for example, 20 years (Gardenia, n.d.) or up to 50 years (Kew Science: Plants of the World Online, n.d.). This will depend on the genotype and certain environmental conditions such as

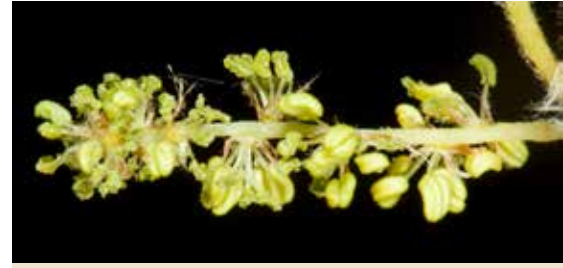


Figure 4. A male catkin of the English oak tree (*Quercus robur*) showing male flower with three to nine stamens. Some anthers have shed the pollen and are now empty, but others have not yet opened to shed the pollen. All photos: Jean-Noël Galliot © Trees for Bees NZ.

temperature, moisture, sunlight, drought, or frost. In New Zealand the light intensity and growing conditions favour rapid tree growth, so the English oak is a tree worth waiting for because once flowering starts, the pollen supply will be great for hundreds of years.

You can establish oaks from seed. English oaks are widely available throughout the nursery trade in New Zealand, from small plants for 'growing-on' to bare-rooted seedlings to small and large-grade potted plants, including seedlings inoculated with truffle spores.