

Hops

Humulus

lupulus

Indispensable in
beer brewing!

Beer making requires four ingredients: **water**, **barley**, **yeast** and **hops**. After the barley has been **malted** to convert starches to sugars, an unlikely fourth plant product, **hops**, are added to make the essential flavour of beer. Specifically, the flowers of the hop vine, *Humulus lupulus*,

confer flavour, aroma and bitterness to beer and also contribute preserving agents allowing beer to be stored for longer periods of time.



Hooked hair (trichome) that facilitates climbing. Image: Phil Gates, *Beyond the Human Eye*:

<https://beyondthehumaneye.blogspot.com/2011/09/hooked-on-hops.html>

Hop vines, sometimes referred to as *bines*, are vigorous climbing plants trained to grow to considerable height up string or wire trellises from a crown of rhizomes. The vertical growth allows for optimum exposure to sunlight in order to maximise photosynthetic capacity. The term *bine* is used for climbing plants that don't have tendrils or suckers, in this case, the stems of hops have hooked hairs that lock onto support structures and twine in a clockwise direction (when viewed from above). In the early 1970s, plant physiologist Jeff Moorby described to us the effect of overspray from an adjoining property of the weedkiller, 2,4,5-T on hop bines in Kent, England. The weedkiller had the effect of reversing the direction of climb (i.e. from clockwise to anticlockwise), resulting in the bines unwinding from their supports and falling in heaps on the ground.

Hop plants can be male or female (dioecious). The seed-free female flowers are preferred by industry because they lack seeds and have higher production of *lupulin* (resin); male plants are usually culled. *Cones* (the flowers of the hop plants) contain **lupulin** glands where alpha acids, beta acids and essential oils, all valued for bitterness



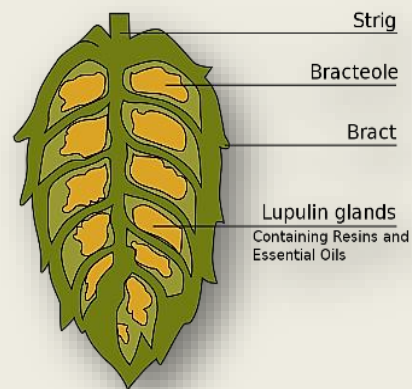
and aromatics, are produced. Aroma, bitterness and high yield varieties have all been enhanced by human selection over thousands of years.

Hops are referred to as *short day* plants. Changes in daylength, together with the degree of

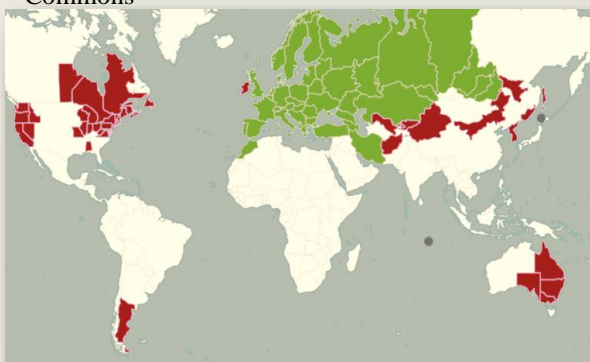
chilling, predetermine the life cycle of hops. The *onset of dormancy* is triggered as the days get shorter, nights longer, and temperatures cooler. At this point, hops start to flower, vines lose their leaves and die back to underground rhizomes. In late winter, early spring, increasing day length, shorter nights and warmer conditions are required to *break the dormancy* of hop plants as young, new-season vines grow from underground rhizomes. Daylength and winter chill requirements vary between cultivars.



Hop cones: Misha Mishko, CC BY 3.0 <<https://creativecommons.org/licenses/by/3.0/>>, via Wikimedia Commons



Cross section of a hop *cone*. Photo: HerrSchnapps, Public domain, via Wikimedia Commons



- Hops – natural distribution
- Hops – introduced (Kew Science)

As is the case with many horticultural and agricultural plant species that have been cultivated for thousands of years, the origin of hops seems difficult to determine. *Kew Science* has the native range from Europe to Siberia, Northern Iran and Morocco.

The first documented use of hops came from a Bavarian abbey near Munich, Germany in the 8th century.

Worldwide, most commercial hop production occurs between latitudes 35° and 55° north or south. In Australia, hop production is centred in Tasmania's Derwent River Valley and in north-eastern Victoria (Ovens Valley near Myrtleford). In 1803, hop plants were grown from seed in Sydney. The early crops were not successful until former convict, James Squires, produced hops at Kissing Point on the Parramatta River, supposedly from seeds selected from those failed early crops. Squires is also credited with having built the first brewery in Australia from which the first beer was brewed in 1804. Beers bear his name to the present day.



In recent years there has been an explosion of craft beer breweries both in Australia and overseas, leading to an increased demand for hops with new and interesting aromas and different levels of bitterness. There are three classes of hops used for commercial production. The bitterness in beer comes from the *alpha acid* present in the *lupulin* of the hop cones; *bitter hops* have alpha acid levels of 8-10% dry weight. Hops termed *aroma hops*, have lower levels of alpha acid which generate a greater diversity of flavour and aroma to beer. *Dual purpose hops* have a mix of alpha acid and essential oils making them ideal for beer production for both bitterness and aroma.

Curiously, hops are closely related to cannabis – marijuana – both belong in the same family Cannabaceae.

Dodds K. 2017. *Hops, a Guide for New Growers*. NSW Department of Primary Industries. [Hops - a guide for new growers \(nsw.gov.au\)](https://www.nsw.gov.au/hops-a-guide-for-new-growers) 44 pp.

Kew Science: [Humulus lupulus L. | Plants of the World Online | Kew Science](https://www.kew.org/plants-of-the-world-online/humulus-lupulus-l)

Nice K. How Beer Works: <https://science.howstuffworks.com/innovation/edible-innovations/beer1.htm>

Wikipedia: https://en.wikipedia.org/wiki/Humulus_lupulus

Alison Downing, Brian Atwell, Karen Marais, Kevin Downing
School of Natural Sciences



MACQUARIE
University
SYDNEY · AUSTRALIA

