# Apple

An **apple** is an edible fruit produced by an **apple tree** (***Malus domestica***). Apple trees are cultivated worldwide and are the most widely grown species in the genus *Malus*. The tree originated in Central Asia, where its wild ancestor, *Malus sieversii*, is still found. Apples have been grown for thousands of years in Asia and Europe and were brought to North America by European colonists. Apples have religious and mythological significance in many cultures, including Norse, Greek, and European Christian tradition.

Apples grown from seed tend to be very different from those of their parents, and the resultant fruit frequently lacks desired characteristics. Generally, apple cultivars are propagated by clonal grafting onto rootstocks. Apple trees grown without rootstocks tend to be larger and much slower to fruit after planting. Rootstocks are used to control the speed of growth and the size of the resulting tree, allowing for easier harvesting.

There are more than 7,500 cultivars of apples. Different cultivars are bred for various tastes and uses, including cooking, eating raw, and cider production. Trees and fruit are prone to fungal, bacterial, and pest problems, which can be controlled by a number of organic and non-organic means. In 2010, the fruit's genome was sequenced as part of research on disease control and selective breeding in apple production.

Worldwide production of apples in 2021 was 93 million tonnes, with China accounting for nearly half of the total.[3]

## Etymology

The word *apple*, whose Old English ancestor is *æppel*, is descended from the Proto-Germanic noun **aplaz*, descended in turn from Proto-Indo-European **h₂ébōl*.

| **Apple** | |
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|  | |
| 'Cripps Pink' apples | |
|  | |
| Flowers | |
| **Scientific classification** | |
| Kingdom: | Plantae |
| *Clade*: | Tracheophytes |
| *Clade*: | Angiosperms |
| *Clade*: | Eudicots |
| *Clade*: | Rosids |
| Order: | Rosales |
| Family: | Rosaceae |
| Genus: | *Malus* |
| Species: | ***M. domestica*** |
| **Binomial name** | |
| ***Malus domestica*** Borkh., 1803 | |
| **Synonyms**[1][2] | |
| ▪ *Malus communis* Desf. | |

As late as the 17th century, the word also functioned as a generic term for all fruit including nuts—such as the 14th-century Middle English expression *appel of paradis*, meaning a banana.[4]

- *Malus pumila* Mil.
- *M. frutescens* Medik.
- *M. paradisiaca* (L.) Medikus
- *M. sylvestris* Mil.
- *Pyrus malus* L.
- *Pyrus malus* var. *paradisiaca* L.
- *Pyrus dioica* Moench

# Description

The apple is a deciduous tree, generally standing 2 to 4.5 m (6 to 15 ft) tall in cultivation and up to 9 m (30 ft) in the wild. When cultivated, the size, shape and branch density are determined by rootstock selection and trimming method. The leaves are alternately arranged dark green-colored simple ovals with serrated margins and slightly downy undersides.[5]

Blossoms are produced in spring simultaneously with the budding of the leaves and are produced on spurs and some long shoots. The 3 to 4 cm (1 to $1\frac{1}{2}$ in) flowers are white with a pink tinge that gradually fades, five petaled, with an inflorescence consisting of a cyme with 4–6 flowers. The central flower of the inflorescence is called the "king bloom"; it opens first and can develop a larger fruit.[5][6]

Blossoms, fruits, and leaves of the apple tree (*Malus domestica*)

The fruit is a pome that matures in late summer or autumn, and cultivars exist in a wide range of sizes. Commercial growers aim to produce an apple that is 7 to 8.5 cm ($2\frac{3}{4}$ to $3\frac{1}{4}$ in) in diameter, due to market preference. Some consumers, especially in Japan, prefer a larger apple, while apples less than 5.5 cm ($2\frac{1}{4}$ in) are generally used for juicing and have little fresh market value. The skin of ripe apples is red, yellow, green, pink, or russetted, though many bi- or tri-colored cultivars may be found.[7] The skin may also be wholly or partly russeted i.e. rough and brown. The skin is covered in a protective layer of epicuticular wax.[8] The exocarp (flesh) is generally pale yellowish-white,[7] though pink, yellow or green exocarps also occur.[9]

Apple blossom

## Wild ancestors

The original wild ancestor of *Malus domestica* was *Malus sieversii*, found growing wild in the mountains of Central Asia in southern Kazakhstan, Kyrgyzstan, Tajikistan, and northwestern China.[5][10] Cultivation of the species, most likely beginning on the forested flanks of the Tian Shan mountains, progressed over a long period of time and permitted secondary introgression of genes from other species into the open-pollinated seeds. Significant exchange with *Malus sylvestris*, the crabapple, resulted in populations of apples being more related to crabapples than to the more morphologically similar progenitor *Malus sieversii*. In strains without recent admixture the contribution of the latter predominates.[11][12][13]

## Genome

Apples are diploid (though triploid cultivars are not uncommon), have 17 chromosomes and an estimated genome size of approximately 650 Mb. Several whole genome sequences have been completed and made available. The first one in 2010 was based on the diploid cultivar 'Golden Delicious'.[14] However, this first whole genome sequence turned out to contain several errors[15] in part owing to the high degree of heterozygosity in diploid apples which, in combination with an ancient genome duplication, complicated the assembly. Recently, double- and trihaploid individuals have been sequenced, yielding whole genome sequences of higher quality.[16][17]

The first whole genome assembly was estimated to contain around 57,000 genes,[14] though the more recent genome sequences support estimates between 42,000 and 44,700 protein-coding genes.[16][17] The availability of whole genome sequences has provided evidence that the wild ancestor of the cultivated apple most likely is *Malus sieversii*. Re-sequencing of multiple accessions has supported this, while also suggesting extensive introgression from *Malus sylvestris* following domestication.[18]

# History

Wild *Malus sieversii* apple in Kazakhstan

"Wild Apples"
by Henry David Thoreau
Read by Kevin S for LibriVox

0:00 / 0:00

Audio 01:01:35 (full text (https://archive.org/details/excursions1863thor/page/266))

*Problems playing this file? See media help.*

*Malus sieversii* is recognized as a major progenitor species to the cultivated apple, and is morphologically similar. Due to the genetic variability in Central Asia, this region is generally considered the center of origin for apples.[19] The apple is thought to have been domesticated 4000–10000 years ago in the Tian Shan mountains, and then to have travelled along the Silk Road to Europe, with hybridization and introgression of wild crabapples from Siberia (*M. baccata*), the Caucasus (*M. orientalis*), and Europe (*M. sylvestris*). Only the *M. sieversii* trees growing on the western side of the Tian Shan mountains contributed genetically to the domesticated apple, not the isolated population on the eastern side.[18]

Chinese soft apples, such as *M. asiatica* and *M. prunifolia*, have been cultivated as dessert apples for more than 2000 years in China. These are thought to be hybrids between *M. baccata* and *M. sieversii* in Kazakhstan.[18]