



# Garden Strawberries

## *Fragaria x ananassa*

Where would we be without strawberries? Strawberry icecream, strawberry jam, strawberry short cake, strawberries dipped in chocolate, pavlova, or Wimbledon, for that matter?

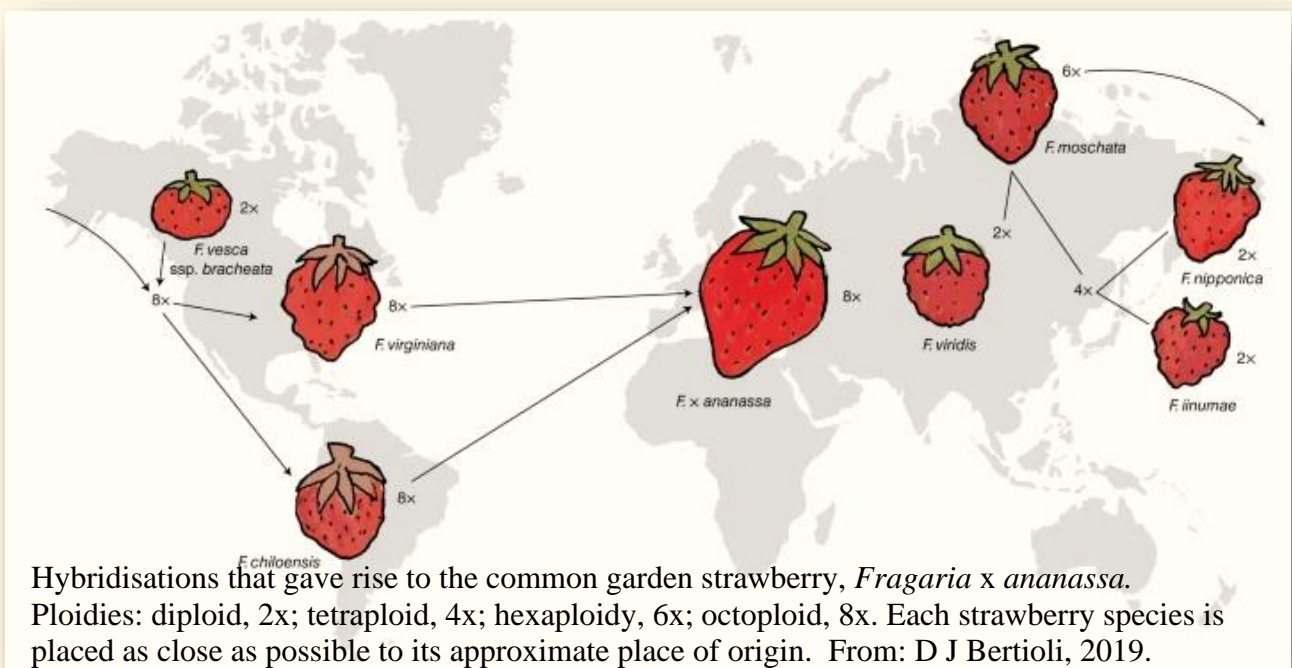
Strawberries are creeping, herbaceous plants that grow from crowns that generate fibrous root systems. ‘Strawberry’ is really a misnomer: the fruit isn’t a *fruit* in strict botanical terms, let alone a *berry*. It’s the tiny dots on the outside that are *true fruits* (achenes) and the fleshy component that we enjoy so much is actually the swollen stem at the base of the flower, termed a *receptacle*.



There are 22 *Fragaria* species, named by Linnaeus, *fragrans* (from the Latin) – sweetly scented. These species are widely dispersed across the New and Old Worlds, North and South America, Europe and Asia. Our modern-day garden strawberries are very different from those sought by early hunter-gatherers, but strawberries are known to have been cultivated in Chile for over 1,000 years.

Not only are the seeds of strawberries small and easily dispersed, but the species are widely dispersed and hybridise easily. Hybridisation of *Fragaria* species has led to the formation of polyploid species, that is, species that contain multiple sets of chromosomes, in this case originating from more than one species. The ‘basic (diploid) strawberry genome’ comprises two sets of seven chromosomes whereas modern strawberries are octoploid, containing no less than **eight sets of these seven chromosomes!** This is not unique to strawberries: when plants are cultivated for domestic purposes, polyploids are often favoured. For example, the flour in the bread you eat has six chromosome sets, demonstrating that bioengineering has been going on for millennia.

Modern day garden strawberries have their origins in four strawberry species. A phylogenetic analysis of *Fragaria* by a team of scientists led by Patrick Edger from Michigan State University, was able to identify all four *diploid* species ancestral to the modern-day strawberry, *F. x ananassa*. The story begins with the hybridization of two Japanese species, *F. linumae* (2x) and *F. nipponica* (2x). Subsequently, the offspring of this union hybridised with a species widespread across Europe and Asia, *F. viridis* (2x). The final connection came when the offspring of those two taxa hybridised with a strawberry from the New World, *Fragaria vesca* subsp. *bracheeata* (2x) to produce an ancestral octoploid about one million years ago. Two present day species, *F. virginiana* and *F. chiloensis* were the result of evolutionary divergence from this ancestral octoploid.







However, perhaps the most relevant information for us is the final link in the chain. In the 17<sup>th</sup> century, the octoploid, *Fragaria virginiana* (8×), was introduced to Europe from North America, and cultivated there where it is one of two progenitors of modern strawberries. In the 18<sup>th</sup> century, military engineer, mathematician, explorer and spy Amédée Frézier brought the white-fruited *F. chiloensis* (8×) to France; remember that this was the other octoploid species that had been cultivated by Mapuche and Picunche Indians of Chile. *Fragaria virginiana* and *F. chiloensis* were grown in close proximity to each other and hybridised naturally, leading to the development of the hybrid, *F. x ananassa* (8×), our modern garden strawberry, favoured for its size, taste, aroma and ease of cultivation.

Edger's team were able to determine that flavour, colour, sweetness and aroma are controlled by the dominant genes from one ancestor, *Fragaria vesca*. Kevin Folta and Christopher Barbey from University of Florida, summed up our modern-day garden

strawberries delightfully: ***“The cultivated strawberry is known scientifically as *Fragaria* × *ananassa*, with the “×” reminding us that it is a hybrid borne of a human-facilitated, blind-date sexual connection between two distantly related New World species, *Fragaria virginiana* (from North America) and *Fragaria chiloensis* (from South America).”***

Bertioli D J. 2019. The origin and evolution of a favorite fruit. *Nature Genetics* 51: 372-373.

Edger, P P, Poorten T J, Van Buren R et al. 2019. Origin and evolution of the octoploid strawberry genome. *Nature Genetics* 51: 541-547

Folta K, Barbey C. 2019. The strawberry genome: a complicated past and promising future. *Horticulture Research*. 6. 10.1038/s41438-019-0181-z.

Wikipedia: <https://en.wikipedia.org/wiki/Strawberry>

Wikipedia: <https://en.wikipedia.org/wiki/Polyploidy>

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