

Grapefruit

Citrus x paradisi

By and large, we take citrus fruits such as oranges, lemons, limes, mandarins and grapefruit for granted. The origin of each of these *everyday* fruits – thanks to thousands of years of domestication, cultivation, selection and dispersal across civilizations – is remarkably complex.

Citrus is a genus of flowering shrubs and trees in the family Rutaceae, widely distributed across Asia, from western Pakistan to China, through south-east Asia to New Guinea, northern Australia and across the Pacific. Recent molecular studies have shown that the centre of origin for *Citrus* species was the south-eastern foothills of the Himalaya, including eastern Assam (India), northern Myanmar, and western Yunnan (China).

Dispersal by people can be traced back a very long time to ca. 3000 BCE, when *Citrus* species were transported from Asia to Micronesia and Polynesia, and c 1200 BCE via Persia, Mediterranean islands to North Africa. More recent introductions to the Mediterranean were lemons, pomelos and sour oranges about 10th century CE.



Citrus x paradisi – yellow fruited grapefruit

a tree that produces a large, sour to semi-sweet, bitter fruit. In Australia, the yellow fruited varieties were common in suburban backyards last century and often a bag or box of freebies would appear in the workplace. More recently we have enjoyed sweeter, pink to dark red fruit. The ancestry of grapefruit has been somewhat of an



Citrus x paradisi – red fleshed grapefruit

enigma but now it is readily accepted that grapefruit originated on the island of Barbados in the Caribbean, a hybrid between the pomelo (*Citrus maxima*) and the sweet orange (*Citrus x sinensis*), both known to be present in the West Indies in 1692. But how did *Citrus* species get to the Caribbean? Believe it or not, in 1493, on his second voyage to the New World, Christopher Columbus brought seed of a range of *Citrus* including citrons, lemons and oranges from the Canary Islands to Hispaniola, now known as Haiti/Dominican Republic. By 1565, *Citrus* were under cultivation in American locations in Florida and South Carolina. Pomelos, crucial in the



Pomelo - *Citrus maxima*. Insert: Sweet Orange – *Citrus x sinensis*

development of grapefruit, were introduced to the Caribbean by Captain Phillip Chaddock ('Shaddock), Governor of Bermuda from 1637 – 1640, probably directly from Asia. By 1830, the *Barbados Grapefruit*, a hybrid between the pomelo and sweet orange was well established.



Christopher Columbus – 2nd Voyage – 1493. On this voyage he brought seed of lemons, oranges and citrons to Haiti

Grapefruit has become infamous in the pharmaceutical industry, as grapefruit–medication interactions are common, increasing the availability of some medications, reducing the availability of others.

The problems for humans are caused by *furanocoumarins*, organic chemical compounds found in grapefruit juice. The furanocoumarins *bergamottin* and *6',7'-dihydroxybergamottin* are responsible for what is known as the *grapefruit juice effect*. They affect certain gut and liver enzymes, such as inhibiting the enzyme CYP3A4, which activates *or* deactivates many drugs, leading to higher *or* lower levels in the bloodstream. The manner in which they can increase or decrease the levels of pharmaceuticals in the bloodstream can be life threatening, hence the warnings not to consume with grapefruit juice found on many medications.

The actual discovery of the *grapefruit juice effect* was purely by chance. David Bailey and colleagues from University of Western Ontario in Canada, were designing a test to determine the interaction between ethanol and felodipine, a prescription medicine used to lower high blood pressure. The taste of ethanol was not pleasant, so the team looked for suitable fruit juices available in a home refrigerator one Saturday evening to mask the taste. Grapefruit juice was chosen. This resulted in lower blood pressure and felodipine concentrations that were many times higher than those observed in other studies of the same drug. A follow up project set up to determine the role of grapefruit juice found felodipine concentrations *five times greater* with *grapefruit* juice than with *water*. Such a chance finding can cause hypertension!

Plant breeding and hybridisation cloud the ancestry of many present-day hybrid *Citrus* cultivars. So be wary consuming grapefruit and other *Citrus* juice with pharmaceuticals.

Alison Downing, Brian Atwell, Jon Duffy, Karen Marais, Kevin Downing and with special thanks to Rekha Joshi.

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MACQUARIE
University
Sydney Australia

