The Origins of White Grapes and Seedless Table Grapes.

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We take grapes and wine for granted and yet there has been some remarkable science to determine the origins of white wines and of seedless grapes. Modern taste in table grapes calls for white skins and no seeds, while white grapes command a large fraction of the wine market. No wonder the history of how grapes became white skinned and seedless is so interesting. The progenitors of modern grape vines all produced red/black fruit but perhaps more than 3,500 years ago, two extraordinary mutations in genes that determine colour led to the evolution of the white grape. These events gave rise to all our white wines and white table grapes today.

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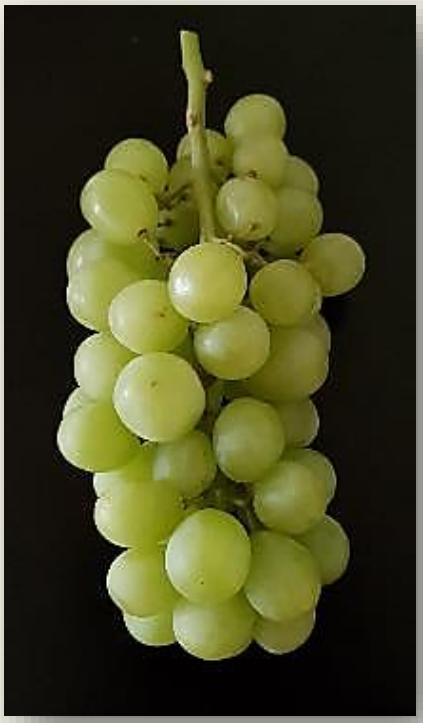
The colour of black grapes and white grapes is dependent on the presence or absence of **anthocyanins**, the red, purple, blue or black water-soluble pigments in the skin of the fruit. Either of the two genes that regulate the colour in grape skins (*VvMYBA1* and *VvMYBA2*) can switch on the production of anthocyanin, therefore both must be inactive through mutation to produce white grape skins.

At some time, rare mutations in *both* genes at the same time effectively *switched off* the mechanism for production of the red pigment, leading to the production of white grapes. All existing varieties of white grape vines are believed to have evolved from one common ancestor and as white wine residue was found in his tomb, this had to be prior to the time of Egyptian pharaoh Tutankhamen.

We tend to expect that modern table grapes will often be white and more often, seedless. Seedless grapes are yet another enigma, and *Thompson Seedless* is one of the best-known varieties. It has ancient oriental origins and is also known as *Kishmish, Sultana* or *Sultanina*. *Seedlessness* occurs when a natural mutation prevents seeds from maturing and developing a hard coat.



The mechanism that produces seedlessness in table grapes is referred to as *stenospermocarpy*. Seedless grapes appear not to have seeds, but the flowers are still normally pollinated and fertilization ensues, guaranteeing normal fruit. However, *after fertilization*, the embryos inside each seed are aborted and the grapes continue to develop without seeds; the remnants of underdeveloped seeds are still visible as tiny specks within the fruit. We now know that the *Seed Development Inhibitor* is a dominant gene that regulates three recessive loci and thereby, determines seed coat hardening and abortion of embryos. You may well ask how is it possible to breed **new cultivars** from seedless grapes and indeed, many other seedless fruits such as banana, some oranges and seedless watermelon? Well, two seedless varieties of grapes can be crossed by what is known as *embryo rescue*. The minute embryos are removed from young fruit before they abort, then grown in tissue culture until they are able to grow on their own.

There are famous white-wine producing regions throughout the world, not to mention some outstanding regions of Australia and New Zealand. However, keep in mind that not all white wine is produced from white grapes. Champagne, for example, is made of three main grape varieties, Chardonnay (a white grape), Pinot Noir and Pinot Meunier (both red grapes). Rapid removal of the skins after crushing allows some of the complex secondary compounds to impart their influence of the wine without tinting it red. These three varieties therefore constitute 99% of grapes approved for the production of champagne.

Seedlessness determined by the *seed development inhibitor* – SDI.
Top: Normal development of a grape, seeds with hard seed coats.
Lower: Grape seeds do not develop hard seed coats in plants where the SDI is active in the plant.
Figure from: Royo C, Torres-Pérez R, Mauri N, et al. 2018.

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

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

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

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

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