

# Mystery solved—biologists explain the genetic origins of the saffron crocus

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Flower of the saffron crocus with three orange carpels. Credit: TUD/Sarah Breitenbach and FISH chromosome analysis

With a price tag of up to €30,000 per kilogram, saffron is the most expensive spice in the world. Sometimes it even exceeds the price of

gold. Its typical aroma is produced by the apocarotenoid Safranal. Saffron is harvested from the flowers of the saffron crocus (*Crocus sativus*), which blooms solely in autumn. In order to yield one kilogram of saffron, 150,000 to 200,000 flowers must be harvested by hand—skilled pickers can collect 60 to 80 grams per day. Subsequently, the three stigmas of each flower are also separated manually and dried. These threads then constitute the spice saffron. Approximately 200 tonnes of saffron threads are harvested worldwide each year.

For many farmers in Kashmir, India, Afghanistan, Iran and Pakistan, the production of [saffron](#) is the main source of income, since the saffron crocus also thrives in soils that cannot be utilised for agriculture. Even in the vicinity of Dresden, the cultivation of saffron has been recently restored after a centuries-long interruption that began in 1570. These local growers swear by the excellent quality of German saffron. Frost makes the plants more robust and the filaments more fragrant. Over the past millennia, saffron has been used as a spice, dye and as a medicine to treat rheumatism and alcohol addictions. For example, saffron was also used as a painkiller during childbirth and for "lady's malaise." According to Greek mythology, Zeus slept on a bed of saffron. In the 14th century "Saffron War of Balsthal," Swiss merchants were even ambushed and robbed.

In order to preserve the fragrance, saffron should not be cooked for long. It is best to soak the threads in warm water for a few minutes and add them to the dish with the liquid when it is almost finished cooking. An even more intense colour can be obtained if the saffron threads are freshly ground. Due to its high value, ground saffron is frequently adulterated by the addition of substances such as pollen from other flowers. Experts therefore advise consumers to buy whole threads.

The saffron crocus is a triploid hybrid [species](#), is sterile and cannot be bred. Although it has been cultivated for more than 3,500 years, all

plants cultivated worldwide originate only from daughter bulbs. For almost 100 years, there has been controversy regarding the possible parent species of the saffron crocus. If the parent species were known, changes could be inserted into the crocus genome by new breeding.

Now, the Dresden biologists have solved this mystery. "We have managed to understand the origins of the saffron crocus and shed light on the parent species using molecular and cytogenetic methods," says Thomas Schmidt, Professor of Plant Cell and Molecular Biology at TU Dresden's Institute of Botany. The paper, titled "Adding color to a century-old enigma: multi-color chromosome identification unravels the autotriploid nature of saffron (*Crocus sativus*) as a hybrid of wild *Crocus cartwrightianus* cytotypes," has been published in *New Phytologist*.

The researchers report that saffron crocus is descended from a single species, the wild species *Crocus cartwrightianus*, found in Greece. Through saffron crocus genome sequencing and comparative chromosome analysis via fluorescence in situ hybridization (FISH) of different crocus species, the biologists demonstrated that genomes of two *Crocus cartwrightianus* individuals with slight chromosomal differences are fused. These findings conclude the centuries-long search for the origins of this plant.

**More information:** Thomas Schmidt et al, Adding color to a century-old enigma: multi-color chromosome identification unravels the autotriploid nature of saffron (*Crocus sativus*) as a hybrid of wild *Crocus cartwrightianus* cytotypes, *New Phytologist* (2019). [DOI: 10.1111/nph.15715](https://doi.org/10.1111/nph.15715)

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