

Fungi add flavor to vanilla

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Vanilla beans drying on the island Réunion. Credit: Ekrem Canli CC BY-SA 3.0.

Worldwide, vanilla is the most popular flavor we know. Vanilla is also a popular product in the cosmetic and pharmaceutical industry, where it is used in perfumes and medicines, amongst other things. The only source of vanilla is the vanilla orchid, which is grown in tropical places such as Madagascar, Indonesia and Mexico. Shahnoo Khoyratty conducted Ph.D. research at the Institute of Biology Leiden into the role that fungi in plants play in the development of the vanilla flavor.

Identical, yet different

Vanilla [plants](#) are not propagated by seed, but by cuttings. As a result, the plants are genetically identical. Nevertheless, the taste of [vanilla](#) can

differ from plant to plant. According to Khoyratty's promotor Robert Verpoorte, emeritus professor of Pharmacognosy, the taste differences are not only related to the growing conditions of the plants. The fungal endophytes that have nestled in the plant also play a role.

Ph.D. candidate Khoyratty investigated which endophytes can be found on vanilla plants and beans on the island of Réunion near Madagascar. He found that leaves and beans contain different fungal endophytes, with clear differences between the leaves and beans and between individual plants. Plants from different regions also appear to have different [endophyte](#) compositions.

Complex taste

Khoyratty investigated whether the endophytes influence the formation of the flavors. He isolated and tested different endophytes during an in vitro study in the laboratory. Several endophytes showed to be able to take a step in the biosynthesis of vanilla. The natural vanilla flavor from beans depends on more than 250 different components. Vanillin is the most important substance in terms of quantity. Khoyratty discovered an endophyte that converts ferulic acid—a substance found in the plant—into vanillin. Another fungus was found to convert vanillin into vanillyl alcohol. This substance provides the typical taste of bourbon vanilla, a high-quality type of vanilla.

None of the fungi studied was able to perform the complete biosynthesis of vanilla, but they could do several steps in the process. "To what extent the fungi are involved in the entire biosynthesis is a question that remains open," says Verpoorte. "It could be that the plant supplies ferulic acid and the endophytes do the rest, or it could be a collaboration between the plant and endophytes. There is still a lot of research to be done."

Vanilla flavor from the industry

The production of vanilla from the [vanilla orchid](#) *Vanilla planifolia* is very labor-intensive and complex; the orchids are pollinated by hand and the beans undergo a lengthy fermentation process after harvest. The demand for vanilla flavor is many times greater than the supply of natural vanilla. The industry uses most of it in cola drinks and ice cream. Vanillin has been chemically produced since the 1920s. In the 1970s, a biotechnological production method was added in which microorganisms produce vanillin based on lignin, a by-product from the paper industry. Ferulic acid from a natural source is also converted into vanillin with the help of micro-organisms. The synthetic vanillin and the vanillin from biotechnology have a less rich taste than the vanilla beans but are much cheaper to produce. Less than 1 percent of the vanilla flavor produced comes from vanilla beans.

Provided by Leiden University

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