

# Terpenes are the world's most widespread communication medium

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Having a good conversation: Soil fungus *Fusarium* and the unrelated soil bacteria. Credit: 21 Lux photography/Heike Engel

If you're small, smells are a good way to stand out. A team of researchers led by the Netherlands Institute of Ecology (NIOO-KNAW) has demonstrated for the first time that two different types of micro-organisms—bacteria and fungi—use fragrances, known as terpenes, to hold conversations. And that's not all: "We actually believe that terpenes are the most popular chemical medium on our planet to communicate through," they report.

Research by microbial ecologists from NIOO and their colleagues has demonstrated that two very different groups of micro-organisms use fragrances to communicate with each other, the most common type being terpenes. In only one gram of soil, billions of micro-organisms thrive, all communicating chemically. This chemical communication is likely prevalent in other life forms, as well, as the research team reports in *Scientific Reports*.

## **A firm conversation**

The researchers have demonstrated that bacteria and [fungi](#) do, in fact, respond to each other—in other words, they can hold conversations. Group leader Paolina Garbeva explains: "Serratia, a soil bacterium, can smell the fragrant terpenes produced by *Fusarium*, a plant pathogenic fungus. It responds by becoming motile and producing a terpene of its own."

The researchers established this by studying which genes were activated by the bacterium, which proteins it began to produce, and which

fragrance by using transcriptomic, proteomic and metabolomic techniques. "Such fragrances—or [volatile organic compounds](#)—are not just some waste product, they are instruments targeted specifically at long-distance communication between these minute fungi and bacteria."

But how widespread is this language of smells? Pathogenic soil fungi such as *Fusarium* also have an effect aboveground, where they make plants sick. Can they communicate with those plants? Garbeva says, "We have known for some time that plants and insects use terpenes to communicate with each other. But we've only just begun to realise that it's actually much wider. There is a much larger group of 'terpene-speakers': micro-organisms."

For fungi, protists, bacteria, and even higher animals, terpenes act as pheromones—chemical signals used by animals—which makes them a regular ingredient of perfumes. So it's likely that the language of terpenes forms a vast chemical communications network, indeed.

## Multilingual

Terpenes are by no means the only volatile organic compounds that are in for a good chat. The researchers found others, as well. Garbeva's Ph.D. student, Ruth Schmidt, the first author of the article, adds: "Organisms are multilingual, but 'terpene' is the language that's used most often."

Who knows? Maybe without realising it, humans are native speakers too.

**More information:** Ruth Schmidt et al, Fungal volatile compounds induce production of the secondary metabolite Sodorifen in *Serratia plymuthica* PRI-2C, *Scientific Reports* (2017). [DOI: 10.1038/s41598-017-00893-3](https://doi.org/10.1038/s41598-017-00893-3)

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