

Truffle aroma – who produces it?

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Truffles are hypogeous fruiting bodies of Ascomycota fungi that obligatorily form ectomycorrhizal associations with host plants. These fungi emit volatile organic compounds, which act as ecological signs for spore dispersal and are synthesized either by the fungi themselves or by associated microbial communities. The black truffle (*Tuber melanosporum*) is highly valued for its distinctive aroma; however, desert truffles (*Terfezia* spp.) occasionally exhibit comparable aromatic profiles. This observation suggests a potential microbial contribution to truffle aroma, particularly involving bacterial communities inhabiting within truffle tissues. Comparative analyses of these microbiomes and their associated volatile organic compounds are central to this investigation. Our results revealed that 3-methylbutanol was detected exclusively in aromatic *Terfezia fanfani* specimens. In these samples, 3-methylbutanal was present at concentrations approximately 170 times higher than in non-aromatic specimens. Similarly, levels of 1-octen-3-ol and (2E)-octenal were found at approximately threefold greater levels. Notably, *Fusarium* spp. was identified exclusively as an endophyte in aromatic truffles. The ongoing isolation and characterization of endophytic bacteria aim to elucidate their role in aroma biosynthesis. These findings offer promising implications for enhancing the aroma and market value of desert truffles via microbiome manipulation, with relevance to the sustainable development of arid and economically disadvantaged regions.

Keywords: Desert truffles; Truffle microbiome; Volatile organic compounds; Endophytic fungi; *Tuber melanosporum*

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