

# The Mysteries of the White Truffle: Its Biology, Ecology and Cultivation

Subjects: [Toxicology](#)

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*Tuber magnatum* Picco is the most expensive of the truffles and a great deal of research has been carried out in an attempt to solve the mysteries of its ecology and biology. However, considerable work remains to be done particularly on those secrets of its life cycle that remain a mystery. It is known that *T. magnatum* is heterothallic, but it has yet to be determined how fertilization occurs between the two strains of different mating types. It is also known that the white truffle is an ectomycorrhizal fungus, and its mycorrhizas can be produced in greenhouses, but then they seem to disappear in the field. The role of other soil microorganisms, fungi and bacteria, on its soil mycelial development and fructification is intriguing but is far from being completely understood. All these uncertainties have made the cultivation of *T. magnatum* extremely difficult and only recently have we had the scientific proofs that it is possible. Even so, many questions remain unanswered and the management practices of *T. magnatum* plantations are still to be better defined to also enable the taming of this truffle.

Tuber magnatum

biological and ecological aspects

aroma

microbiome

mycorrhizas

Truffles are fleshy ascomycetous fungi that generally fruit underground. The spores are sequestered in the fruiting body (the ascoma or ascocarp), which consists of a more or less subspherical mass. Many researchers prefer to consider as “true truffles” only the Ascomycota in the genus *Tuber* belonging to the Tuberaceae family and in the order Pezizales <sup>[1]</sup>. There are more than 180 species, all characterized by an ectomycorrhizal habit and naturally are mostly restricted to the Northern Hemisphere <sup>[2]</sup>. The phylogeny of the genus has been studied by many authors <sup>[3][4][5]</sup> with the most recent by Bonito et al., 2013 <sup>[2]</sup>, which provided a complete phylogenetic analysis of the genus and its recognized 11 main clades: *Aestivum*, *Rufum*, *Excavatum*, *Gibbosum*, *Japonicum*, *Puberulum*, *Macrosporum*, *Maculatum*, *Multimaculatum*, *Melanosporum* and *Gennadii*. Although all the *Tuber* species are edible, only four are considered culinary delicacies and command really high prices: *Tuber melanosporum* Vittad. (Périgord black truffle) in the *Melanosporum* clade, *Tuber borchii* Vittad. (Bianchetto truffle) in the *Puberulum* clade, *Tuber magnatum* Picco (Italian white truffle) and *Tuber aestivum* Vittad. (Burgundy truffle) which are both included in the *Aestivum* clade.

Undoubtedly, *T. magnatum* ranks above the others because of its intense aroma and unique flavor. As a consequence, Italian retail prices for *T. magnatum* are higher than for any other truffle and make it one of the world's most expensive foods <sup>[6]</sup>, with prices ranging from 1000 to 6000 EUR kg<sup>-1</sup> <sup>[7]</sup> and a business of about 0.9 billion EUR year<sup>-1</sup> <sup>[8]</sup>.

In poor production years such as 2007 and 2021 <sup>[9]</sup>, when dry summers reduced production, prices reached 7000 EUR kg<sup>-1</sup>, and outside of Italy in upmarket stores such as Harrods in London, prices reached dizzying heights. In

this entry, the distinctive morphological characters of this truffle are described as well as its biology and ecology. The current status of its cultivation is reported, which emphasizes the gaps in our knowledge that actually limit the possibility of taming this truffle in contrast to the other European species of *Tuber*.

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## References

1. Mello, A.; Murat, C.; Bonfante, P. Truffles: Much More Than a Prized and Local Fungal Delicacy. *FEMS Microbiol. Lett.* 2006, 260, 1–8.
2. Bonito, G.; Smith, M.E.; Nowak, M.; Healy, R.A.; Guevara, G.; Cázares, E.; Kinoshita, A.; Nouhra, E.R.; Domínguez, L.S.; Tedersoo, L.; et al. Historical Biogeography and Diversification of Truffles in the Tuberaceae and Their Newly Identified Southern Hemisphere Sister Lineage. *PLoS ONE* 2013, 8, e52765.
3. Percudani, R.; Trevisi, A.; Zambonelli, A.; Ottonello, S. Molecular Phylogeny of Truffles (Pezizales: Terfeziaceae, Tuberaceae) Derived from Nuclear rDNA Sequence Analysis. *Mol. Phylogenet. Evol.* 1999, 13, 169–180.
4. Jeandroz, S.; Murat, C.; Wang, Y.; Bonfante, P.; le Tacon, F. Molecular Phylogeny and Historical Biogeography of the Genus *Tuber*, the ‘True Truffles’. *J. Biogeogr.* 2008, 35, 815–829.
5. Bonito, G.; Trappe, J.M.; Rawlinson, P.; Vilgalys, R. Improved Resolution of Major Clades within *Tuber* and Taxonomy of Species within the *Tuber gibbosum* Complex. *Mycologia* 2010, 102, 1042–1057.
6. The Most Expensive Food in The World: 13 Costly Food Items. Available online: <https://luxurycolumnist.com/the-most-expensive-food-in-the-world/> (accessed on 20 September 2022).
7. Leonardi, P.; Baroni, R.; Puliga, F.; Iotti, M.; Salerni, E.; Perini, C.; Zambonelli, A. Co-Occurrence of True Truffle Mycelia in *Tuber magnatum* Fruiting Sites. *Mycorrhiza* 2021, 31, 389–394.
8. Heinonen, I. The Soil Bacteria Associated with *Tuber magnatum* Productive Sites. Master’s Thesis, University of Helsinki, Helsinki, Finland, 2021.
9. Urbani, O.; (Truffleland s.r.l, S. Anatolia di Narco, Perugia, Italy). Personal communication, 2022.

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