Scientists reveal the sex wars of the truffle grounds

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Truffle from Mont-Ventoux. Image: Wikipedia.

They are one of the most highly prized delicacies in the culinary world, but now scientists have discovered that black truffles are locked in a gender war for reproduction. The research, published in *New Phytologist* as the truffle season begins, represents a breakthrough in the understanding of truffle cultivation and distribution.

The teams, led by Dr Francesco Paolocci and Dr Andrea Rubini from the CNR Plant Genetics Institute in Perugia and by Dr Francis Martin from INRA in Nancy, carried out their research on the reproduction strategy of the highly prized black truffle, *Tuber melanosporum*, which is grown across southern Europe. During the truffle season, between late autumn and winter, fruiting truffles can grow up to 7cm in diameter, weighing up to 100g with a value often measured in hundreds of Euros.

'Fruiting' is the crucial part of the truffle life cycle, occurring when the fungi interacts with and colonises host plants, usually at the roots. However, the process which causes this transition from vegetative to reproductive state remains unknown.

"It is commonly believed that truffles, like other fungi, are homothallic, meaning that they reproduce themselves," said Paolocci. "Because fungi that reproduce this way do not need a sexual partner it was believed that truffle cultivation relied only on the environment and nutrition, now we know that is wrong."

Taking advantage of the information provided by the T.melanosporum genome sequencing project led by Martin and from molecular analyses carried out by the Italian team, research now proves that truffles do outcross, meaning they are a two gender species, with sexual reproduction occurring between strains of opposite mating types.

The team studied samples of wild black truffle strains on plants from a natural truffle ground near Spoleto in central Italy. The study revealed that black truffle strains of opposite gender were not evenly distributed beneath potentially productive soil patches.

The team then studied the dynamics of truffle strains on host plants, artificially inoculated with truffle spores and grown in a greenhouse, which showed that a competition occurs between strains to colonise the host plant roots even under controlled conditions.

The truffle fruiting season traditionally begins in late autumn but sexual reproduction is believed to occur in spring. The Italian team demonstrated that during the latter season strain of opposite gender are present in the soil samples next to colonised host plants and that the host plant colonising strain acts as maternal partner in the reproductive process.

These findings represent a breakthrough in the understanding of truffle reproduction tactics as well as the dynamics of black truffle strains in both open-field conditions and on host plants produced to boost truffle production.

"These results are of considerable practical use for optimising and increasing production in truffle fields," concluded Paolocci. "It is of paramount interest to artificial truffle plantations to encourage a balance of strains of both mating types. Future investigations will allow us to determine whether the distribution of mating types is a factor that truly limits truffle fruiting body production."

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