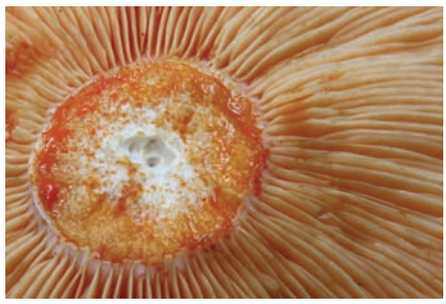
By Dr Ian Hall

Truffles and much more

TRUFFLES, porcini and all the other edible mycorrhizal mushrooms have a lifestyle very different to the mushrooms I talked about last month. Instead of growing on dead animal or plant remains, they form an intimate partnership with the roots of trees. So close is this relationship that neither the fungus nor tree can survive without the other. And this relationship goes further because not just any tree will do for the fungus (and vice versa). For example, the saffron milk cap will only grow on the roots of pines while the painted bolete grows only with Douglas fir.

The fungi provide the tree with minerals from the soil and in exchange the tree provides the fungus with carbohydrates and, most importantly, a place to live.

Because of the intimate nature of the mycorrhizal partnership, none of the true edible mycorrhizal mushrooms can be cultivated using the techniques that have been developed for button mushrooms and their ilk (see last month's *New Zealand Lifestyle Farmer*). Instead, the fungi first have to be put onto the roots of young trees of the right species.



Left: A saffron milk cap fruiting in Hannes and Theres saffron milk cap plantation near Nelson. Right: A saffron milk cap bleeding its orange sap where the stalk has been removed from the cap.

Of paramount importance is that the nurseries producing the trees ensure that the fungus is there in sufficient quantity for it to survive after the trees are planted in the field. Obviously, if the wrong fungus is put on the trees then the chances of the right mushroom fruiting will be less than likely.

A number of fungi that lurk in corners of greenhouses can also cause problems because they can oust the fungus of choice. So to give a buyer confidence that the right fungus is on the roots, some nurseries employ specialists who either use DNA techniques (Linnaeus laboratories, John@linnaeus.co.nz) or microscopic techniques (e.g. hance.maria@gmail.com and truffle1@ihug.co.nz) to check what is there.

Some important edible mycorrhizal mushrooms

Some common names	Scientific name	Some host trees	Typical retail prices for fresh mushroom sin NZ$ per kg based on an exchange rate of 1.00 = NZ $2.00
Italian white truffle **	Tuber magnatum	Hazelnut, oaks, poplars, willows	$5000 to $300,000
Périgord black truffle *	Tuber melanosporum	Hazelnut, European lime, hornbeam, oaks	$1000 to $5000
Bianchetto truffle *	Tuber borchii	Beech, birch, cedar, chestnut, European lime, fir, hazelnut, hornbeam, larch, oaks, pines, spruce	$500 to $3500
Burgundy truffle *	Tuber aestivum	Beech, birch, cedar, chestnut, European lime, fir, hazelnut, hornbeam, oaks, pines, spruce	$50 to $800
Porcini *	Boletus edulis (and similar species)	Beech, birch, European lime, oaks, pines	$50 to $120
Chanterelle	Cantharellus cibarius	Conifers and deciduous trees	$50 to $120
Matsutake **	Tricholoma matsutake	Primarily pines	$100 to $5000
Saffron milk cap *	Lactarius deliciosus	Pines	$40 to $80

* These grow naturally or are being cultivated in New Zealand
** Attempts are being made to cultivate these in New Zealand

Photographs: Dr Ian Hall

The painted bolete only grows with Douglas fir.

Two tiny saffron milk caps less than one centimetre across have begun growing from the mycelium decomposing the litter layer.

Truffles and much more

Alfredo Tofani displaying $100,000 of Italian white truffles (photo courtesy the Tofani family and Foto Paci).

A bianchetto truffle forming just at the soil surface on Jeff Weston's truffière at West Melton, near Christchurch. Other less valuable truffles are often confused with bianchetto.

It is really important that the soil conditions and temperatures at the planting sites suit both the fungus and the tree.

Truffles must have a free draining, high pH soil rich in lime. In the natural Périgord black, Burgundy and bianchetto truffle areas of France, Italy and Spain, up to 50 per cent of the soil is limestone.

Similar soils are found in New Zealand such as in North Otago, North Canterbury and the Hawke's Bay but our most successful truffières (truffle plantations) have been on soils where the pH has been lifted by adding large amounts of lime a year or two before planting, a technique pioneered in New Zealand and since adopted in Australia, Chile, the USA and elsewhere. While sufficient water is also important, irrigation can make up for any seasonal shortfalls.

One other important problem facing the cultivation of truffles and above ground mycorrhizal mushrooms, are competing fungi on the roots of trees at the planting site. For example, if there are oaks, pines, poplars, willows or other ectomycorrhizal trees present then the fungi on their root systems might become established on your expensive new investment. So a careful choice of planting site is required.

Unlike the truffles, many of the mycorrhizal mushrooms that fruit above ground do not require the soil to be modified and, provided the soil texture and nutrient concentrations are acceptable, competing fungi aren't present, and the climate is right, trees carrying their fungal payload can be planted with relatively little site preparation.

The delay between planting and first production varies widely between the mushroom/truffle being grown, the location, and a whole range of other things some of which we know almost nothing about – sometimes fruiting bodies may never form even though a grower has followed instructions to the letter.

For the above-ground mushrooms the first production can be only 18 months after planting but the truffles can take much longer.

The prize for patience must go to John and Iris Burn in Ashburton, who had to wait 13 years for their first Périgord black truffle. I had all but given up hoping they would be successful, something John rubbed in with glee when he telephoned to give me the good news. Delightful.

Of course, the underground fruiting truffles carry with them a major problem: where to look. In the early days of New Zealand's embryonic truffle industry there were few specially trained truffle dogs.

Alice, the pig on Alan and Lynley Hall's Périgord black truffle plantation, preferred to eat the truffles she found, later to be washed down with copious quantities of avocado. And MAF's Boss, New Zealand's first successful truffle dog, preferred to bark at cars.

Then there was Juliet who was neither pig nor dog but an elegant lady with the capacity to sniff out truffles – much cheaper than a truffle

Harvesting wild truffles and mycorrhizal mushrooms is a major industry in many Northern Hemisphere countries. Here Maria Cullen and Howard Fox collect hedgehog mushrooms, an Irish favourite.

Alan Hall hunting Périgord black truffles with dog Brock.

dog, which might cost $10,000, and she would work all afternoon for a couple of glasses of wine.

But before you rush out into the garden fired up by the thought of the riches 100kg of truffles per hectare per year selling for $4500 per kg will bring, and dig up your rose garden and perhaps throw 100 tonnes of lime per hectare at it (10kg per square metre), it would be a good idea to have a look at our little book *Taming the Truffle*. And for the foresters among you who are only interested in timber, dwell on Hannes and Theres Krummenacher's saffron milk cap production on radiata pine which last season generated more revenue per tree than the timber will be worth at maturity (see the January issue of the *New Zealand Lifestyle Farmer*).

Some further reading

For background information on mycorrhizas: Mycorrhizal associations: The web resource. http://mycorrhizas.info/index.html

***Taming the Truffle* by Ian Hall, Gordon Brown and Alessandra Zambonelli, published 2008, available from Ian Hall, truffle1@ihug.co.nz**

***Edible and poisonous mushrooms of the world* by Ian Hall and colleagues, published 2003, available from Ian Hall, truffle1@ihug.co.nz**

Truffles Mushrooms Mycorrhizas The website of Truffles and Mushrooms (Consulting) Ltd. www.trufflesandmushrooms.co.nz

De Licio (Edible Forest Fungi NZ Ltd) www.effnz.co.nz