Truffles – How to increase your chances of finding the Hypogeous Fungi

Hypogeous fungi have evolved to develop and mature underground, although a few species are erumpent, forcing their way to the surface at maturity. An advantage to developing underground is likely to be more stable growing conditions (e.g. fewer fluctuations in moisture levels). Many truffles develop at a rather leisurely rate below ground compared to their aboveground relatives. It is worth bearing in mind that during spells of warmer weather when epigeous fungi are thin on the ground, truffles can often still be found below ground.

Since they grow underground, truffles require a mechanism for broadcasting spores to a wider area. Their solution is to give off an aroma at maturity, detectable at the soil surface, which attracts the attention of foraging animals (primarily mammals) who grub them up, ingest them, and spread the spores via their faeces. There are a wide variety of aromas in truffles, although garlicky, musky, and fruity are the more commonly encountered smells.

How to find truffles

Most Tuber species prefer alkaline soil, however many other truffles can be found in a range of soil types (e.g. Elaphomyces sp. are often found in more acid soils). It is worth bearing in mind that localised pockets of alkaline or neutral soils can occur in predominantly acid habitats. Towns and cities have a wide variety of soil types (imported soils, etc.). I have found a wide variety of species in the largely acid and neutral environs of Manchester and West Yorkshire.

Don't assume that truffles won't grow in your area. They are pretty much ubiquitous in the UK. SOME species are likely to be growing nearby.

Ovcaviania asterosperma

Melanogaster broomeanus

Tuber rufum

Where to look for truffles:

When seeking out truffles without the aid of a trained dog or pig, the key to success is to look for evidence of animal dig holes (truffle-sign). The large majority of truffles are mycorrhizal so look under or near to suitable partner trees. Oak, birch, linden, hornbeam, and beech have proved to be the most fruitful species in my experience, however, willow, hazel, pine, larch, spruce, fir, and eucalyptus, amongst others, are all truffle hosts.

From early summer to the first heavy leaf-fall of autumn, the manicured lawns of parks, gardens and grassy-verges are excellent places for finding truffles since it is easy to spot dig holes against the green background. Grass cover allows for greater moisture-retention, so in the summer, this habitat is typically much more fruitful than the drier leaf litter and bare soil of woodlands. In wet summers and through autumn, woodlands are also excellent habitats for truffles, however excavation holes are less easy to spot against a leaf or soil background.

"Truffles are, in fact, easier to find than most people realise. Looking for them is both challenging and fun." David Arora, 1986.

Dig Holes

It's worth considering that not all dig holes are truffle-related, however a LOT are. Getting to know what **isn't** a truffle-related dig hole can save a lot of fruitless time-wasting, so is a skill worth developing.

Acorn excavations are very common, particularly the year following a mast-year. Look out for acorn-shaped secondary holes within the dig hole, and/or acorn peelings or scraps beside the hole. This applies equally to other nuts such as hazelnuts, etc.

Animal burrows. Generally avoid any hole if you can't see the bottom of it. Animal latrines where faeces of rabbit, fox, or badger, in particular, sit within a scrape or dig, can fool initially.

Past, decayed, or eaten mushroom fruitings can leave 'holes' in the grass or soil. These tend to be rather uniformly cylindrical holes rather than scrappy dig holes.

Truffle-related dig holes can vary from small scrapes in the grass/soil, to large golf-ball size excavations. Sometimes a well-defined secondary hole can be seen within the main hole where an exposed truffle has then been plucked from the hole by the foraging mammal.

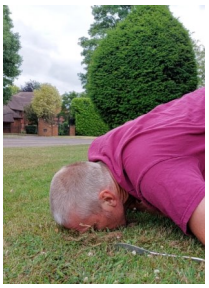
Various truffle-related holes.

So why look for dig holes if the truffles have been removed already? Dig holes are an excellent clue to the presence of truffles. Like mushrooms above ground, truffles will often develop in groups underground, and a foraging animal (usually a squirrel) may remove just the mature specimens of the bunch. So with a little gentle extending of the existing hole, further specimens often pop up. With larger species of truffle, the foraging animal may struggle to remove the entire fruitbody, simply nibbling the exposed flesh. So finding partially eaten truffles still in the hole is a frequent occurrence. I've even found entire truffles that have been dropped in the dig hole, presumably when the animal was disturbed during excavation. Occasionally truffles can develop underground in a fairy-ring, and this can be noted when a series of dig holes produces a well-defined ring. This is a useful clue that the dig holes are truffle-related, rather than e.g. acorn-related. Small dig holes on grass are often easy to miss. One clue to their presence is a tuft or scattering of dried grass and/or moss on the grass surface. On closer inspection, dig holes are often detectable. If you're lucky enough to have suitable host trees or hedging in your garden, do keep a look out for squirrel activity in those areas. Catching truffle-excavators in the act can up the chance of finding fresh truffles.

How to assess dig holes:

Initially you want to visually assess the hole, looking for evidence of truffle scraps (which can be sufficient for ID in some cases), or the exposed surface of a buried truffle. You can then prod around with a finger extending the hole slightly, whilst feeling for resistance. Stones, for example, feel very firm, but truffles when felt, tend to have a bit of give to them. It's worth noting that the size of dig hole can vary from less than an inch to a good few inches across. In grassed areas it is preferable to minimise how far you extend of the dig holes. In leaf litter or needle-duff you could extend each hole by a few inches up to about one sq. ft. It is important to avoid more extensive excavation, which can damage the local ecosystem, including mycelium. Once investigated, it is essential to cover over any excavation holes. The most fruitful dig holes are usually ones that have been made fairly recently. If the soil at the surface looks moist, even on a dry day, then it is likely very recent, and the chances of finding fresh specimens increases. Equally, holes that have cobwebs over them are usually poor candidates for finding fresh specimens in. Once detected, truffles can be removed with further excavation or using a blunt knife such as an artist's palette knife. On unearthing, make notes about the colour of the peridium (outer layer of the truffle) and note any colour changes over time. The aroma of the truffle may be absent if immature but do make a note of any interesting smells noted. These clues may prove invaluable when it comes to identifying your finds.

When an actively producing site has been found, one further technique to increase the number of, and different species of, truffles found is to put your nose to the ground. Whilst a poor alternative to a dog's nose, the human nose can detect truffle aromas at the soil surface without much difficulty. If in a public space, it takes a certain kind of thick skin to apply this method in earnest. But it does work!



Most truffles grow within the top 2-3 inches of soil (although they will sometimes grow deeper), so limiting excavation to this kind of depth is usually sufficient. I rarely dig any deeper than 2 inches.

I should add that it can feel disheartening prodding in multiple holes and failing to find any truffles. This process is definitely a numbers game. Keep looking and eventually you WILL have success. Over time it is possible to hone your skills so as to be able to recognise locations that look likely to yield truffles, and at the same time waste less time examining e.g. old or acorn-related dig-holes.

Note: since soil can contain sharp stones and broken glass, you may want to consider wearing a gardening glove before prodding around. This will limit ones sensitivity to detecting resistance in the soil, but can still be effective. Another option I use is a short-stemmed screwdriver which can be stirred in the hole, firmly enough to loosen up the soil, but not enough to damage any truffles within.

A site that is favourable to one species of truffle will often have multiple species growing at the same time. I frequently find 2, 3 or 4 species under the same tree. Consider re-visiting sites on subsequent years as again, different species can show up.

Melanogaster broomeanus, Tuber rufum and Hymenogaster sp.

Tuber rufum and Hymenogaster sp.

Tuber aestivum and Russula (Gymnomyces) cerea

It is worth noting that truffle records DON'T necessarily reflect where they are or aren't to be found. They typically feature only as a very occasional find in the majority of the UK fungi recording groups. Finding truffles takes time, patience and a particular technique, however it is reasonably easy to have success with persistence. The assumption is often that truffles are rare and unlikely to be found. However the paucity of records compared to many other fungi found aboveground is largely a reflection of their underground habit, being out of sight. The most commonly recorded hypogeous species in the UK is Rhizopogon luteolus, an erumpent species that grows with pine, and in most, if not all cases, will have been spotted protruding through the soil surface. The Elaphomyces, both E. granulatus and E. muricatus, are the next most frequently recorded of the hypogeous species. These, however, develop and remain underground at maturity, and as anyone actively searching for truffles will know, are by far the most common species that you will be encounter. They are almost certainly many times more abundant than the Rhizopogon, however records don't reflect this. A note on the Elaphomyces. This group of fungi are slow-growing and can be found throughout the year. They develop a tough, warted outer cortex, and have a low moisture content compared to other hypogeous species. As such, they are happy growing slowly in e.g. dry, bare, beech woodlands. In the summer months, Elaphomyces are the ONLY species of truffle I've found in this kind of habitat. Most other hypogeous fungi

need more forgiving habitats where moisture levels are at least a bit higher. I've found truffles near streams, rivers and ponds, but the majority of my finds haven't been close to a water source. However I do avoid areas where the soil is baked and cracked or particularly dry-looking. As mentioned above, grassed areas do a good job of retaining moisture sufficient to favour truffle growth. With moisture levels in mind, looking near to and below moisture-retaining logs may be fruitful. It is suggested that truffles can sometimes be found growing within the punky wood of decaying logs, although I have no experience of this.

Truffle Lookalikes to be aware of:

Plant material such as bulbs, tubers, corms etc. are often excavated by foraging animals and can be found in dig holes when looking for truffles. Animal faeces can look pretty truffly at times too! Some fungi are easily mistaken for truffles by novices, and these include Earthballs (Scleroderma sp.), Puffballs (Lycoperdon sp. etc.), and immature Stinkhorns (Phallus sp. etc.). It is important to note that immature mushroom primordia can develop below ground before forcing their way through the surface as they grow. These primordia typically look like tiny mushrooms, but as in the case of the genus Amanita, many develop within a universal veil or sac that gives the young mushroom the appearance of a small ball or egg, that could be mistaken for a truffle. On cutting an Amanita button in half distinct mushroom structures should be visible, including the cap, stem and gills. As mentioned above, mushroom-munching slugs will sometimes leave behind remnants of the stem base, which when found as such, can look like partially nibble truffle in a hole. I've been fooled like this a few times, only to discover the mistake under the microscope where the expected truffle features have been absent. A final truffle-alike that is easy to be fooled by is the root gall of the wasp Andricus quercusracicis, that develops at the base of oak trees. The gall produced is sufficiently truffle-like for the wasp to be given the name the Truffle Gall Wasp. Once cut open the flesh of the gall, if licked, will pucker the tongue due to high levels of tannins.

Cyclamen corm

Bird poo masquerading as a Hymenogaster

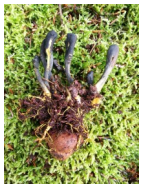
Mushroom stem base

Oak Truffle Gall

Some British Truffles

There are 90+ species of hypogeal fungi known to grow in the UK, and by matching technique with suitable habitat, all may potentially be unearthed. Part of the fun of truffle-hunting is the complete lottery of possibilities. You never know which species will show up. Apart from the very large dig holes, typical of excavations of the Summer Truffle (Tuber aestivum), most truffle-related dig holes look rather similar. On finding truffles in a hole, it is wise to explore other near-by holes as well, since it's not uncommon for multiple species to be found under the same tree at the same times.

Elaphomyces – The Deer Truffles

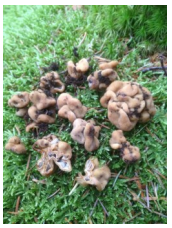


This group of truffles are the most frequently encountered in the UK, being widespread and common. They typically have a hard, granular exterior, with a black, dusty spore mass in the interior. They play host to parasitic fungi in the genus Tolypocladium, the Truffle-Clubs, that sprout fruiting spikes from the underground truffle, visible on the woodland floor. On excavating the fungus, the truffle host can be found.

Elaphomyces muricatus - The Marbled Deer Truffle is common throughout deciduous woodland in the UK. On cross-section, the outer layers show a marbled pattern, not visible in other members of the genus.

Elaphomyces granulatus is similar but has a smoother, less granular, exterior surface, and lacks the marbling of E. muricatus. It is found with both coniferous and deciduous woodland.
There are a number of newly described species of Elaphomyces, so any material that doesn't quite fit E. granulatus or E. muricatus are good candidates for DNA sequencing.

Hydnotrya – The Fold Truffles



The Hydnotrya are related to Gyromitra, the False Morels, and produce convolutely folded and hollowed fruitbodies.

Hydnotrya cubispora - The Cubed Fold-Truffle is an imported species found in conifer plantations mostly in the north of the UK. Whilst there are very few records for this species, I encountered it in three different locations in a six week period, a strong indication that records for truffles really don't reflect the actual picture under the ground. This species has very distinct cuboid spores.

Hydnotrya tulasnei – The Red Fold-Truffle is an uncommon find under deciduous trees. It is less hollowed and folded than the above species, with a red/brown interior. It has large golden spherical spores (20-30µm).

Tuber - The True Truffles

This is the genus in which most of sought-after gourmet species are found. Depending on the species they vary from pea to potato-sized and the surface of the outer layer (peridium) can be warted, smooth or slightly hairy. Microscopic examination is required to identify some species, however others are distinct enough for field ID.

Tuber aestivum – The Summer Truffle

The Summer Truffle is a common species with a preference for alkaline soil types. In summertime I usually find this species in association with oak, but it likes to grow with hazel, beech and hornbeam, amongst others. The large dig holes associated with animal excavations of this species are reasonably distinct, and often contain unharvested or partially eaten specimens. The spores are spiny.

Tuber rufum - The Red or Cinnamon Truffle

This is probably the most common species of the genus in the UK (although it is seems to be a species complex so may represent a number of distinct species). This little truffle is widespread and common in the UK, usually under deciduous trees. At maturity it develops a strong smoky aroma reminiscent of smoked almonds. The spores are spiny.

Tuber borchii – The Whitish Truffle

This small to medium-sized species is an uncommon find in the UK under both deciduous and coniferous trees. At maturity it gives off a very strong, truffly aroma, probably the strongest of the UK species. The spores have a honeycomb-like mesh on their surface.

Tuber rapaeodorum

This small species of Tuber looks similar to the Red Truffle (Tuber rufum) when young, but as it matures it develops a strong, punchy, garlic/radish smell. The spores of this species have a distinctly uniform honeycomb-like mesh. The size of the meshes along with Q ratio (spore length divided by spore width) help to differentiate from the similar T. puberulum, T. foetidum, and T. dryophilum.

Balsamia

The Balsamia are represented in the UK with two very similar-looking species that require the microscope to differentiate. Getting to Balsamia in the field is easy, however, as the reddish-brown surface is covered in small raised warts. At maturity they give off a yeasty, truffly to unpleasant aroma.

Balsamia platyspora – The Broad-Spored Balsamia

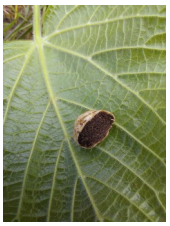
This is a small species that is uncommon in the UK. It has broader spores and thicker peridial cells than the below species.

Balsamia vulgaris is a small to medium-sized species of Balsamia which has narrower spores and thinner peridial cells than the above species. It is a rarely recorded species in the UK.

Paurocotylis pila – The Red Berry Truffle

This truffle is an introduced species from New Zealand, first recorded in 1973. It remains an uncommon species, usually found growing under berry trees such as Yew or Rowan. It seems that the red fruitbodies are ingested by foraging birds, hence the occurrence near fruit trees. Unusually, this truffle acts as a saprotroph, and lacking the more-permanent mycorrhizal relationships of other truffles, can be transient, showing up in an area for a one-time-only fruiting. This is one of our erumpent species, bursting through the soil at maturity.

Hymenogaster – The Nut Truffles



This is a fairly large group of relatively small white or yellow False Truffles (basidiomycetes). The gleba (inner-flesh) of these truffles is extensively chambered. They typically have yellow-brown limoniform (lemon-shaped) spores. The size of these, and presence or absence of mucronate apex (sharp point) and myxosporium (a layer on spore surface) can aid ID.

Octaviania asterosperma - Chalky False Truffle

This small to medium-sized white truffle stains dark blue/black on damage/handling. It is an un-common species known from damp, beech woodlands on calcareous soil. Under the microscope, the star-shaped spores are distinctive. This is another erumpent species that can be seen bursting through mossy banks at maturity.

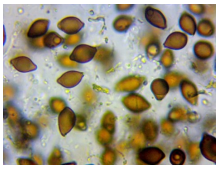
Melanogaster – The Slime Truffles

These are a small group of dark- spored false truffles closely related to the Paxillus (Roll-Rims). At maturity the gleba of Melanogaster become wet and slimy, developing a range of smells, from fruity to repugnant.

Meloanogaster broomeanus – Broome's Slime Truffle

This fairly common truffle develops a heady aroma of ripe pears at maturity. The spores are the smallest of the three UK species. This species was historically known as the Bath Truffle and was apparently sold at markets.

Melanogaster ambiguus – Stinking Slime Truffle



Another fairly common and widespread species, this one develops the stench of landfill gasses at maturity. A single mature specimen was said to make a room uninhabitable, and I can attest to this. The spores are dark brown and limoniform (lemon-shaped).

Rhizopogon – Beard Truffles

This is a group of false truffles related to the Boletes that are found growing in association with conifers. Most are erumpent, so are found above ground at maturity.

Rhizopogon luteolus – Yellow Beard Truffle

Compared to most other truffles, there are large numbers of records for this species. No doubt a reflection of its visibility above ground at maturity. It is a an especially frequent encounter in Caledonian pine forests. The spores of this species are sold as a soil inoculant to enhance plant growth.

Some Useful Reference Material:

Truffles – A Revision of British Truffles (D. N. Pegler et al., 1993)

British Hypogeous Fungi (Lilian Hawker, 1953) available free online via: www.ascofrance.com/uploads/forum_file/Hawker-British-Hypogeous-Fungi-0001.pdf

Facebook Group: Hypogeous Fungi of Europe

Three Rarely Recorded Truffles (Carol Hobart) in Field Mycology Vol 10 (1)

Eucalyptus—A Host for fungal Aliens New to the UK (Carol Hobart) in Field Mycology Vol 13 (2)

Tuber mesentericum Recorded in Britain in 2011 (Carol Hobart) in Field Mycology Vol 12 (1)

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