The Cultivation of *Copelandia cyanescens*

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Introduction

Copelandia cyanescens is fairly easy to grow and gives a reasonable yield. My specimens were grown from spores supplied by Pacific Exotic Spora. There are different opinions on the taxonomy of species in *Panaeolus* and some mycologists do not recognise *Copelandia* as a genus. The mycelium grows rapidly on malt dung agar (MDA) and fruits abundantly when horse manure is added to grain. Although the fruiting bodies are small they are extremely potent. The *Copelandia* casing layer eventually succumbs to blue mould and must be discarded although it should yield around 40 g of mushrooms (fresh weight) per 100 g rice/horse manure. *Panaeolus cyanescens* (spores from PES) is also very potent but has a weaker mycelium which gives smaller specimens and a much lower yield (10 g per 100 g rice/horse manure). The casing layer also succumbs to blue mould. These tropical species grow at similar temperatures to *Psilocybe cubensis*. Spores of *Copelandia cyanescens* and *Panaeolus cyanescens* are difficult to distinguish. Both are lemon shaped and give black deposits. *Copelandia cyanescens* measure around 9.5 x 11 µ while *Panaeolus cyanescens* are 11 x 12 µ and clump together less (each division in the photomicrograph below is 1.9 µm).

It is my personal view that Hawaiian *Copelandia cyanescens* offers the entheogen user a more enjoyable experience than the more easily cultivated *Psilocybe cubensis.* In fact I would place it in the *premier cru* of psychedelic plants, alongside the indigenous Liberty Cap (*Psilocybe semilanceata*) and the various DMT containing plants.

Making an Inoculation Chamber

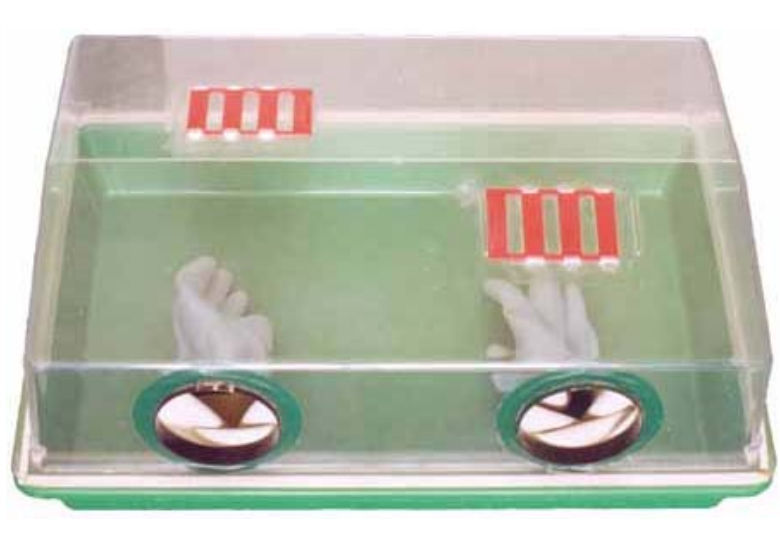
Mushroom mycelium has no hard protective skin, unlike flowering plants, so it is liable to attack by other micro-organisms. In nature each mushroom will produce millions of spores very few of which will reproduce. When working indoors we must therefore first construct an inoculation chamber to ensure sterile conditions. Mushroom laboratories use Laminar Flow Hoods where a powerful fan forces air through a large HEPA filter, but these are very expensive.

My inoculation chamber is based on an idea of Stephen Peele's (see FMRC). A 61 x 39 x 30 cm (24" x 15" x 12") glass aquarium is turned on its side. The exposed edges are rubbed with emery paper to make them less sharp and the narrow strips of glass at the top and bottom of the opening are removed. A sheet of polythene is Sellotaped to the front panel and the bottom left hanging for the operator to put his hands through. Alternatively two vertical slits can be cut in the polythene for this purpose. When exposed material is inside the bottom edge is held in place with tape (it need not be airtight). Hot sterilised items should be placed inside on a mat or plate rather than on the glass and the scalpel blade and tweezer tips must be flamed outside. An angle-poise lamp can be positioned over the aquarium.

A glass aquarium is preferable to a perspex one as it is superior optically and much harder to scratch. Although less portable and larger than necessary, I prefer large aquaria as they allow plenty of room for movement. The inside is misted with a few sprays of a 10% solution of thin (detergent free) bleach each time it is opened when working with exposed material. A plant or cosmetic spray bottle is ideal for this purpose. The spray bottle should be clearly labelled and kept in a safe place - if children are around it is safest to empty it between uses. Cosmetic spray atomisers may eventually block, even when deionised water is used for dilution, due to the chlorine. To extend its life it can be flushed through with water after each use. Gloves must be worn in the aquarium when bleach is present to protect the skin - thin rubber gloves with talcum powder work best. (I use a tissue for swabbing as cotton wool sticks to the rubber.) The inside surface of the aquarium can be wiped clear with the gloves. A mask with a charcoal filter should be worn as chlorine is very irritating to the mucous membranes. Avoid using the aquarium on quality furniture as the bleach spray causes staining of varnish and also stains clothing.

It is also possible to construct a glove box from a plant propagator tray with a perspex lid. Two holes are cut in the lid and washing-up gloves fitted. This model measures 56 x 37 x 22 cm (from B&Q stores). Although this glove box allows less air exchange than the aquarium design, I no longer use it as hand movement is very restricted and the height is inadequate for inoculating Kilner jars.

Aquarium



Glove Box

Horse Manure

Horse manure is a mixture of droppings, urine and straw which is allowed to rot down in a sealed plastic bag to preserve the nutrients. Common *Agaricus* mushrooms are grown commercially on composted horse manure. Various supplements are added and the process is rather complicated. Coprophilous (dung growing) species are less demanding. When used in the garden it is not unusual to see wild mushrooms growing on horse manure. While cubensis fruits abundantly on cased grain, copelandia and panaeolus grow poorly on this medium. Personal hygiene is essential when working with manure as some farm animals harbour the deadly strain of E coli which is frequently in the news. Avoid using kitchen utensils with unsterilised horse manure and wash hands after preparation. I sterilise a small quantity in a Kilner jar which I save for making the MDA below. Alternatively poultry manure pellets can be used.

Spore Germination

MDA (Malt Dung Agar)
For each 8 oz jar:

25 ml water
0.5 g agar agar
0.5 g malt extract (light dried or use 0.5 ml syrup)
0.25 g horse manure or poultry manure pellets - copelandia grows poorly on MEA (Malt Extract Agar)

The quantities are not critical but the solution must be contain at least 1.5% agar to solidify. Agar is made from seaweed and is sold as powder or flakes in Health Food shops. It is sometimes labelled "agar agar" to distinguish it from gelatine "agar" which is made from animal sources. Light dried malt extract is available from home brew outlets. Mycelial growth is less vigorous on dark malt extract syrup.

MDA Ingredients - Agar, Malt Extract, Horse Manure

Preparation

Agar Media before Sterilisation

Spraying Aquarium with Bleach Solution

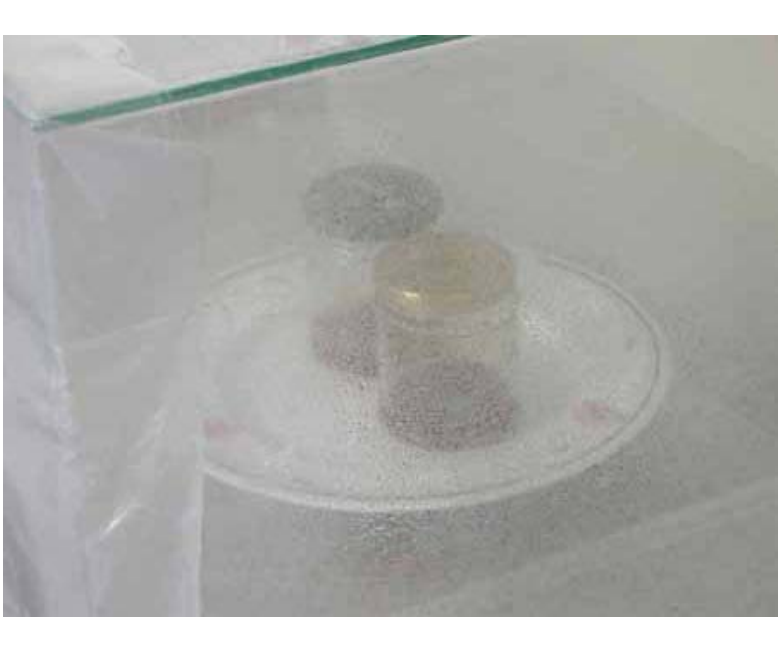
STEP 1
Make up the media as above. Heat the liquid sufficiently in a saucepan to stir in the malt, or use a Pyrex mug in a microwave, then pour into 8 oz jars. It is important to have a reasonable depth of agar for inoculating grain jars later. Thin sections tend to stick to the jar side making inoculation more difficult. Ensure that any media is cleaned from the jar thread to avoid contamination entering later. If an accurate balance is available, it is more precise to add the ingredients separately to each jar as they are difficult to mix in a mug since the manure in not soluble. Add 500 ml of cold water to the pressure cooker. Pressure cookers are normally supplied with a basket and a rest to stand vegetables out of the water. Insert these or some similar utensil in the cooker and place the jars inside it. The lids should not be completely tightened.

STEP 2
Sterilise the jars for 20 minutes at 15 psi (1.05 kg/cm^2).

STEP 3
Close all doors and windows to prevent draughts and allow the pressure cooker to depressurise slowly. Depressurising rapidly will cause the media to boil excessively. Spray bleach solution into the aquarium. While wearing a thick pair of gloves remove the lid and place the jars on a plate in the aquarium. Spray more bleach solution. If any lids have come off the jars in the cooker they should be replaced immediately (usually they will be okay). If any lids become seized on by vacuum a flamed screwdriver tip should be used to lift the edge.

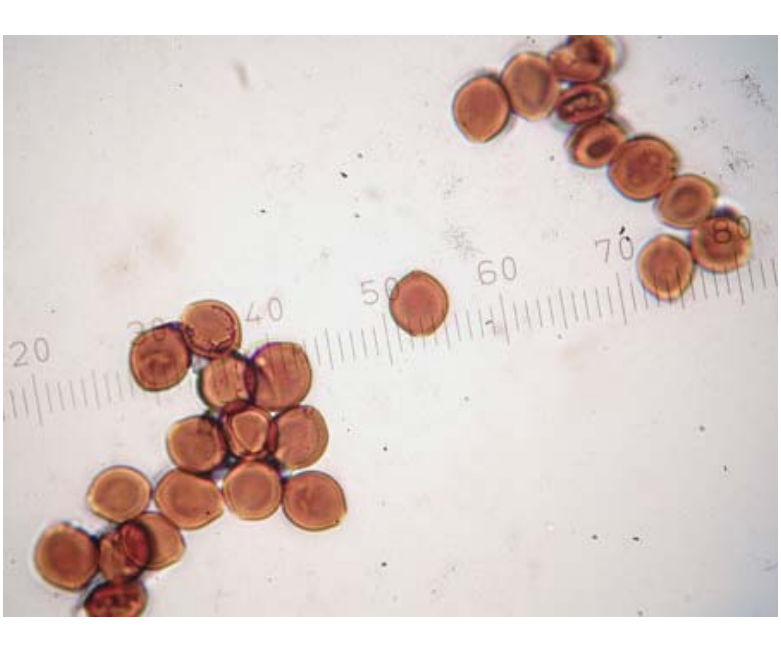
STEP 4
Once the media has solidified it can be inoculated (agar solution solidifies at 32 ºC). Swab a scalpel and tweezers with isopropyl alcohol or surgical spirit and flame the scalpel blade outside the aquarium. Rest them inside on something so that the blade and tweezer tips are not touching anything. Put on the gloves and mask and then pull the spore print partly out of its bag with tweezers inside the aquarium. While holding the print through the bag scrape the scalpel blade tip across the spores. If necessary the print can be placed on a saucer that has been swabbed with isopropyl alcohol (not surgical spirit which leaves a residue). The smallest speck can contain thousands of spores although some prints have to be scraped hard to remove them. Scrape the spores onto the surface of the agar in the centre of each jar. Always open lids as little as possible and close them quickly to reduce the risk of contamination. Do not allow any agar to remain on the spore print as it will attract contaminants. The lids are then tightened.

STEP 5
The jars are then incubated in a warm place (the top of an airing cupboard is ideal if you don't yet have a combi boiler). They should be stood upside down to keep moisture off the agar and can be heated up to 27 ºC. The temperature range can be checked over a period with a max/min thermometer to ensure it is not too hot.



Agar Media Cooling

Scraping Spore Print



***Copelandia cyanescens* spores**

***Copelandia cyanescens* mycelium on Malt Dung Agar**

When working with more than one set of jars each should be labelled with a permanent marker or a Chinagraph pencil. Only write on the glass because permanent marker ink cannot be removed from some lids (ink can be removed from non-porous surfaces with meths). Fresh spores should germinate within a week although older spores can take up to three weeks. In the warm copelandia mycelium should fill a small jar about two weeks after inoculation, although it will not grow to the edge due to the lack of air exchange in the jars. For maximum growth the lids can be fitted with synthetic filter wool (from aquarium shops), although filters are never 100% effective. If liquid was present on the surface of the media the spores may be dispersed and germinate from different points. Any liquid present can be rolled around the side of the jar to remove condensation when viewing. It is essential to inoculate grain with fresh mycelium - in time it flattens and becomes less vigorous.

Copelandia mycelium is white and frequently develops a radial structure. Any coloured mycelia will be moulds from airborne spores. If these appear the media should be disposed of as spores will have been shed inside the jar. A slimy ring around the rim indicates bacterial contamination.

Grain Culture

For each litre Kilner jar:

180 g (dry weight) wholegrain rice
90 g thoroughly wetted horse manure (or 45 g poultry manure pellets and 45 ml extra water)
180 ml water
1 g gypsum

Some brands of rice are impossibly sticky. Rice can be tested by rinsing in hot water – if the water remains clear it is suitable. Easy cook rice, also known as parboiled rice, is pressure steamed to modify the starch. Any easy cook brown rice should be okay but Tesco American easy cook brown rice is ideal. Ensure that the ingredients are thoroughly mixed and heat immediately before the gypsum solidifies. The addition of gypsum (calcium sulphate) is particularly useful with rice grain to reduce clumping. Available from craft shops as Plaster of Paris.

STEP 1
Add 1 litre of cold water to the pressure cooker (the larger quantity of water is needed for the longer sterilisation time). Place the filters inside the plastic screw bands and tighten them on the Kilner jars (see Spawn Jar Filters in Resources section). Bring up to pressure with moderate heat and sterilise at 7 psi (0.5 kg/cm^2) maximum for 90 minutes. The pressure must be allowed to drop by itself as releasing it causes a sudden drop in temperature which can crack the jars. Shorter times do not give adequate sterilisation and higher pressure will crack the jars.

STEP 2
Remove the Kilner jars from the pressure cooker wearing thick gloves and check carefully that there are no cracks. Then shake the jars to separate the grains. The jars should be held upside down whilst shaking vigorously to dislodge the grain from the bottom (a little liquid may drip through the filters). It may be necessary to drop the jars upside down on to a floor mat from a couple of inches to dislodge rice grain. Only tighten the lids gently whilst hot as they will tighten as they cool. If the jars are allowed to cool without shaking they will need re-heating for a short period.

STEP 3
Allow the grain jars to cool completely before inoculating in the aquarium. A large section of agar must be used for grain in order to maximise the number of inoculations. I use two quarters of a small jar culture to inoculate each Kilner jar. Use bleach misting, gloves and mask. Cut the culture into quarters and spear them with a flamed scalpel to transfer them to the jars. One fully colonised small jar will adequately inoculate up to 4 Kilner jars - ideally all the jars should be inoculated at the same time. Open the jar lids as little as possible when transferring the media. Tighten the screw bands and shake the Kilner jars thoroughly in all directions to inoculate the grains. Label the jars with a permanent marker or Chinagraph pencil.

STEP 4
Incubate the grain jars in a warm place. They can be stored on their sides provided that the grain does not obstruct the filters, as mycelium grows quicker in less dense grain and it is less susceptible to Wet Spot. If the agar quarter has stuck culture side to the glass the jar may need re-shaking after the mycelium has grown through to the exposed surface. The mycelium will disappear on shaking but recover in a couple of days. In the warm the spawn should be ready in about a week. The grains will be stuck together with a fine white growth. A little moisture may be present as a waste product of the mycelium. Avoid re-shaking the jar if there are uncolonised patches (less likely with rice) as this encourages Wet Spot which thrives in anaerobic conditions. If green mould spots appear or the jar smells bad when the lid is removed due to Wet Spot, dispose of the grain. Wet Spot can often be smelt through the filter - filters are never 100% effective.

Laying Out Spawn

Some growers simply case the grain in the jars. This requires a large number of Kilner jars and the mushrooms are difficult to pick. Laying out the grain is more convenient and gives a better yield. A 2 litre ice cream tub (19 x 15 cm) or a similar sized sandwich box base makes a suitable container. This is then placed inside a larger container with water to maintain a humid atmosphere.

STEP 1
The tub should be stood for a half-hour in a warm bleach solution (keep the lid on to prevent fumes) and then rinsed before use. This will kill any mould spores surviving from previous use. Boiling water is also effective but deforms the tub.

STEP 2
A tablespoon should be placed in a mug of boiling water for a few moments, shaken dry and allowed to cool. The jars should be well shaken to separate the grains before pouring into the tub. Any large lumps should be put back into the jar with the spoon and re-shaken. The last grains may have to be dug out. The spawn is levelled off by pressing it with the spoon. Using the 2 litre ice cream tub should give about 40 mm depth of spawn. In hot weather the grain can sometimes dry out and not spawn after re-shaking. It may recover if the bottom of the tub is covered with a thin layer of wetted vermiculite.

STEP 3
A plastic box with transparent lid or cover should be bleached as above and rinsed. The bottom surface is covered with water and the tub stood inside it. (The water is changed every fortnight - always use cold tap water as the chlorine will help keep it fresh.) The lid is placed on the box to maintain high humidity - alternatively a polythene sheet can be taped over the top. Condensation will form on this lid. If too much condensation forms and drips onto the grain, the lid can be opened slightly to reduce the humidity. A fine white mycelium will completely cover the grain after a day or two with copelandia and cubensis. If a few grains remain uncolonised the spawn can still be cased normally. If the grain is cased before the mycelium reappears, foul smelling Wet Spot will develop and the spawn will be lost.

***Copelandia cyanescens* spawn on rice/horse manure**

Spawn ready for casing

Casing Ingredients

Pasteurisation Apparatus

Casing and Cropping

Peat mixed with chalk (calcium carbonate) or lime (calcium oxide) is used for casing in *Agaricus* cultivation. Moss (Sphagnum) peat is the type preferred - the heavier sedge peat is unsuitable. It is usually sold in 60-80 litre or larger size bags. Moss peat has a low pH value that is too acidic to be used alone. It also has a low nutritive value. A quantity of chalk or lime is added to buffer the acidity, making the pH value more neutral. Moss peat and garden lime powder should be used in the ratio 2:1 by weight (8:1 by volume) for copelandia. For easy mixing the dry ingredients can be placed in a sealed container and shaken.

Moss peat compost makes an excellent casing for cubensis and unlike raw peat is available in small quantities. It is less acid than raw peat and has nutrients added. Garden retailers describe this product as compost although it has no connection with garden or mushroom compost.

Dry casing is sprayed to achieve an even moistness and then pasteurised. Pasteurisation is preferable to sterilisation because it preserves benign micro-organisms which delay contamination by the lower fungi. Sterilisation is adequate for copelandia although it is not recommended for slow growing species such as *Psilocybe cyanescens*. Untreated peat/lime and compost casings become contaminated very quickly by *Trichoderma*. I find that cubensis pins quicker and more abundantly on compost than on peat/lime. I use peat/lime with copelandia as I have found compost to be susceptible to Cobweb mould (*Dactylium*) when it is not rapidly colonised by mushroom mycelium.

STEP 1
Place sufficient pre-mixed peat/lime casing in a saucepan and wet until moist. I use a chip pan which has a gap in the lid for the basket handle, through which a winemaking/homebrew thermometer fits. The thermometer should touch the base of the saucepan and a piece of paper towel should be wrapped around it to prevent steam escaping from the hole. The pressure cooker base is filled with hot water so that the saucepan floats on the surface - see above. (Placing the thermometer in the water is adequate if a suitable saucepan is not available.) Alternatively the saucepan can be placed in any large pan. If it is too heavy to float, it can be stood on the pressure cooker's upturned perforated basket. The casing is pasteurised for an hour at 71-82 ºC (160-180 ºF). It is advisable to turn off the heat before the temperature reaches the lower limit as it will continue to rise for some time. If it reaches the upper limit the saucepan should be removed from the water and replaced when it drops to the lower limit. Once the system is stable, only occasional heat will be needed to maintain the casing between these temperatures.

OR

Place the moistened casing into a casserole dish with a lid and microwave until steaming hot.

STEP 2
Apply the casing once it has completely cooled and replace in the plastic box with transparent lid. Use just enough to cover the spawn, no more than 10 mm depth. The casing should have an uneven open surface and should not be compressed. A little water should appear when the casing soil is squeezed between thumb and forefinger but it should not be saturated.

STEP 3
Mycelium should appear on the surface of the casing layer after a few days. If the casing starts to dry it should be sprayed regularly from a height with a fine mist so as not to damage the mycelium. If mycelium does not appear the casing should be completely ruffled up by scraping the surface of the spawn to allow air exchange. In the unlikely event that this fails the casing may need to be thinned. Once mycelium is visible the air should be changed regularly by fanning. Alternatively an aquarium pump tube can be placed inside the box to provide air exchange - place the tube into water to maintain humidity. Mushroom metabolites have a distinctive (not unpleasant) smell. Copelandia primordia (pins) should appear after a week. If the surface becomes completely overlaid with mycelium add more casing.

STEP 4
The stems of copelandia continue growing long after their caps have opened and are tenaciously attached to the casing. Scrape any casing from the bottom of the stems. You will see an instant bluing reaction on the stems after picking. Carefully tip out any liquid from the bottom of the tubs as this will encourage contamination.

***Copelandia cyanescens* pins appearing**

Six days later

Growing in Humid Box

Mature Specimens

Generally yields are larger in a humid environment. However if the humidity is too high black patches can appear on the caps due to Bacterial Blotch (*Pseudomonas*). Blotch should be wiped off the caps and the humidity reduced by raising or partly removing the lid. Excessive humidity stops the caps opening fully and reduces spore production. Keep the casing moist by spraying when necessary.

Copelandia succumbs to contamination much earlier than cubensis, the spawn and casing turning blue. Growing copelandia is particularly difficult in hot weather when daytime temperatures are much above 20 ºC. Small patches of contamination and the surrounding area can be sprayed with bleach solution. I have tried replacing contaminated casings in containers and in Kilner jars but they become re-infected because the spawn itself is contaminated.

Fungicides are used by commercial growers. These kill lower fungi while the higher fruiting fungi remain unaffected. Fungicide residues may present health risks so I avoid them. Spraying with pyrethrum is very effective if flies become a problem at fruiting. This natural insecticide is extracted from the pyrethrum daisy and is usually mixed with piperonyl butoxide to make the pyrethrins more effective. These compounds have very low toxicity and are used on edible crops and in medicine.

Airborne spores have been known to cause health problems in the mushroom industry. To reduce exposure the plastic box can be fanned outdoors or the mushrooms picked before the veil breaks. Boiling mushrooms for a few seconds and drinking the cooled water should avoid any allergic reaction - best to repeat to extract everything.

Spore Printing

Select a mature specimen on which the cap has fully opened and remove the stem - copelandia caps develop better when the humidity is reduced by raising or partly removing the lids. Place a strip of white paper on a saucer in the aquarium. Lay the cap onto the paper and cover with a glass, after spraying the inside of the glass with a fine mist. After 24 hours spores should be visible - leave for a couple of days to get a dense print. Remove the glass and cap and allow the print to dry. Once dried it should be folded, placed in a flat re-sealable bag and frozen. Frozen copelandia spore prints remain viable for many years, unlike cubensis, although mycelial cultures will only keep a few months on MDA in a fridge (see DSMZ, Medium 781 for a more elaborate media recipe).

Preserving Mushrooms

The simplest way to preserve mushrooms to dry them thoroughly and then freeze them. I lay them out on a plate in the top of the airing cupboard - psilocybin is destroyed in air at temperatures over 50 ºC. The mushrooms should be dried hard before being bagged and frozen. Copelandia loses far less potency than cubensis during drying.

Making an Incubator

The traditional home airing cupboard makes an ideal incubator. However they are fast becoming redundant as more efficient combination boilers are being installed which dispense with loft tanks and external boilers. So we can make an incubator by using a plastic box with a flat base and a clear lid, and placing it on a reptile heat mat or a demijohn heater. Inevitably there will be a temperature gradient between the base and top of the box so a spacer is used to prevent the jars touching the hot base and a 12V computer fan is suspended with string - using bolts with spacers looks more professional but is very noisy. The fan is connected to a mains adaptor and can be run at lower voltage to reduce noise further – be careful not to reverse the polarity as these fans have no diode protection. The jars are placed upside down to keep the media dry and a temperature probe is attached with White Tack. Kilner jars are placed on their sides ensuring that the filters are not blocked - the jars are far more susceptible to Wet Spot contamination when placed upright. Up to 27 ºC is ideal for copelandia agar and grain culture although cased copelandia spawn should not be heated above 21 ºC as it becomes more susceptible to blue mould - in this case water should be added to the plastic box to maintain high humidity and the fan should be set to its slowest speed to prevent the casing from drying out. Monitor the temperature and use a plug in dimmer or a thermostat, if required. A twin channel thermostat can be used enabling agar and grain to be kept at 27 ºC in one box while spawn tubs are kept at 21 ºC in a second box.

Mushrooms and the Law

The UK government has placed all psilocybin containing mushrooms under Class A of the Misuse of Drugs Act from 18 July 2005. Cultivation or sale now carries a maximum sentence of life imprisonment. Sadly our government has little interest in civil liberties and ignores the overwhelming evidence that mushrooms are less harmful for most users than tobacco or excessive drinking. Although no one has been sent to prison yet for mushrooms in the UK, I think it would be prudent to adopt a strategy to minimize our risk exposure. Here's mine:

- Avoid synthetic psychedelics as the risks to the manufacturers and distributors are enormous
- Never sell mushrooms to anyone - encourage them to grow their own
- Only grow and store small quantities
- Be aware that communications can be monitored - use PGP encryption (see PGP Guide) or a Hushmail account for sensitive emails

A Cautionary Note

Psilocybin mushrooms are very powerful. They are probably best avoided if one is not in good spirits as the experience can be overwhelming. They should also be avoided at times of illness as they may suppress the immune system. If you use mushrooms alone and encounter difficulties, an experienced companion can be helpful to sit or take a walk with. If you prefer to wander alone, I would recommend taking a mobile phone, a plastic water bottle and avoiding traffic. Obviously one should never drive or operate machinery whilst under their influence - it is best to avoid driving until the following day as one's own assessment can be deceptive. Be careful not to leave magic mushrooms anywhere where they might be eaten by children and do not use them during pregnancy.

Half a gram of dried copelandia should produce strong effects (dry weight is around 14% of fresh weight). If preferred, a liquid extract can be taken after boiling the mushrooms for a few seconds - best to repeat to extract everything. Taken on an empty stomach the full effects should be reached after an hour and a half and reasonable normality should return after four, although it may not return completely until the following day. Even with higher doses I haven't noticed that the effects last much longer. Taking mushrooms after food tends to cause indigestion and will delay the onset of effects.

In case of adverse effects, have drinking water handy in a plastic cup or bottle. Absolutely no glass. Caffeinated drinks should be avoided as should alcohol, cannabis or any other drugs. Psychotic symptoms can be overwhelming but should improve over time if the person is kept calm, ideally with the minimum of illumination. In this event any future experimentation should be undertaken at a reduced dose.

Resources

Pressure Cooker
Select a model having low and high pressure controls, usually 5 and 15 psi (0.35 and 1.05 kg/cm^2), that can hold a pair of litre Kilner jars. I use an old Tower Rapide Chef 4305 which has 7 and 15 psi weights. Any 6 litre Tower model with dual weight settings should do (some only have a 15 psi weight), but check with your jars first for height. Prestige and Tower make larger High Dome aluminium pressure cookers which can be set between 5 and 15 psi by adjusting the heat, but they need watching when sterilising Kilner jars to ensure they don't go over pressure. Argos stores do a good selection. Cooking oil is rubbed around the gasket for lubrication. Large gasketless autoclaves are used commercially (the All-American range is available from Fungi Perfecti). Once sealed autoclaves don't emit steam. The pressure is read off a dial and adjusted by heat.

Spawn Jars
I use traditional preserving jars with filters which are inoculated with agar media. Spawn bags are also available with self healing injection patches for syringes. Buying spore syringes every time is expensive and making your own requires a lot of spore prints. Personally I find jars much easier to work with. (Preserving jars are known as canning jars in the US.) Use a preserving jar with a screw band – see the Kilner jar above. They should be sterilised at 7 psi (0.5 kg/cm^2) maximum. At 15 psi they frequently crack. Kilner jars are no longer manufactured although Ball and Leifheit both make screw top preserving jars with the same size mouth. Of course you could use any jar with a metal screw top (PVC caps will deform when sterilised while polypropylene is indestructible). Make a few holes in the lid with a bradawl from the underside so that the burrs don't push against the filter (otherwise too much air would pass through the filter). Autoclave the filter to shrink it, allow to dry and trim with scissors to give a tight fit under the lid. Alternatively a single hole can be made in a metal lid and filled with synthetic filter wool (from aquarium shops).

Spawn Jar Filters
The spawn jars are fitted with autoclavable filters to allow air exchange without micro-organisms entering. I have also grown spawn by removing the rubber sealing rings from glass Kilner lids and tightening the plastic screw band over them to allow some air exchange. (In some American guides the metal sealing disc is inverted and the screw band tightened.) Although the resulting spawn looks healthy the casing becomes contaminated with *Trichoderma* very rapidly. Even if mushrooms are produced the disease free period will be reduced. I wasted a considerable amount of time with this method because the contamination present in the spawn is not visible to the naked eye.

Reusable wide mouth filter discs are available from Fungi Perfecti - they are advertised as 90 mm although the filters are 85 mm in diameter. Initially they are very tight under Kilner screw bands but shrink about 1 mm with use to give a perfect fit. They also fit Ball and Leifheit jars. The filters become stained with use and should be bleached between uses to keep them sterile (this does no harm as they are made from a synthetic material). I soak them in a mild solution in a Kilner jar until clean (use a lid to prevent fumes). The filters should have their surface area restricted to reduce evaporation from the jars. Draw a circle around a 5 pence piece (18 mm diameter) with a pencil and apply gloss paint to the outer area - see above. If the jars are used for slow growing species the filter aperture can be further restricted with tape to prevent the grain drying out prematurely, or the jars can be stored in a humid box.