Growing Mushrooms by Mrca

by

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**Introduction to cultivating mushrooms**

**What is a mushroom?**

Due to the lack of scientific knowledge fungi were classified as plants for a long time. Today's understanding of genetic and physiological facts show that fungi are more closely related to animals than plants. Unlike plants they neither are able to carry out photosynthesis nor can they produce the carbohydrates they need.

Mushrooms are dependent on organic carbohydrates, built up and provided by other creatures to feed themselves. In the life cycle of organic matter they operate as biodegradant destruents, who disintegrate organic material and dissolve soluble minerals.
Three distinguished groups

On reference to their different nutrient sources fungi can be distinguished into three groups:

Saprophytes decompose organic material like cow dung, wood waste or straw. These fungi are the most important recyclers within the ecological system. This group includes the majority of cultivated mushrooms. It must be mentioned that fungi - like most other live forms - grown in vitro react differently in comparison to their natural forms: With idealised mushroom substrate at hand, bounteous harvest can be reached. Mushroom substrate is a highly specific, nutrient-rich product consisting of selected organic and inorganic matter for the purpose of cultivating mushrooms.

Under natural conditions only a few mushroom heads arise out of a vast amount of mycelia. And they only appear during short periods of the year.

Mushrooms can also live as parasites. These fungi develop at the expenses of another living organism (=host). True parasites are dependent on their host, who provides shelter and nutrition, though they usually do not kill them. Worth mentioning: honey fungi (Armillaria spp.) are probably the largest living creatures on earth with individuals expanding to a surface area of several thousands of square meters, reaching up to 800 meters in depth.

Some fungi live as Symbionts in a mutual beneficial relationship. If a fungus interacts with the roots of a plant, mycorrhiza is formed and establishes a bidirectional flow of nutrients. The fungus provides inorganic nutrients to the plant since it dissolves inorganic matter a lot easier. In exchange the plant affords carbohydrate assembled in photosynthesis. Furthermore the mushroom mycelium retains a great amount of water which is disposed to mycorrhizal plants in periods of dry weather.

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Production of spore prints

Spores are the "seeds" of mushrooms. They are microscopic and are mainly produced at the under part of the cap. After its fully-fledged they are released. To collect the spores, the fully developed caps are placed on a carrier material. The obtained spore print can be used to start a new mushroom culture. Placing spores on convenient substrate (most common are malt-agar substrates in Petri dishes) induces mycelium growth.

Recommended Tools:

- Aluminium foil, paper (as large that you can place 1 mushroom cap on it)
- Bazillol - workspace desinfect
- Latex Gloves
- Facemask and hairnet
- Skalpell
- Cover (zb Tupperbox)
- Zipp-Lock Bags to pack the prints

Sterile working area: Glove Bag/Glove Box or sterile air flow (HEPA-filter, Laminar Flow Hood)
Proceed cautiously as sterile and clean as possible. The spores should not get in contact with contaminations while taking the print. Put on face mask, hairnet and gloves; clean the working area in front of the HEPA-filter or the Glove Box inside and disinfect the container and the aluminium foil. (The needed tools are already inside the Glove Box). Finally disinfect your gloves and allow drying off.

Cut off the designated mushroom cap carefully at the upper end of its stem; try not to damage the gills and pores. The disinfected aluminium foil collects the spores dropping out; transfer the cap with its lower surface briskly on to the foil. Cover them up in the disinfected container, for best result the caps should not dry out and stay clean while donating spores.
After 12 to 24 hours the spores should have been released, favourably they adhere to the foil by themselves. (Wear protective clothing, clean and disinfect working area and tools!) Remove the cap by impaling the upper surface on a scalpel. Do not touch the foil or spore print to avoid contamination. Be sure the residual moisture is allowed to evaporate before packing the print. Sealed in an airtight zip-lock bag, spores stay viable for about one year. Store your spore prints at room temperature in a dark and clean place.

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**Microscopic examination of spores**

**Recommended Tools:**
- Sporeprint or Sporesyringe
- Microscop (40x - 1000x)
- Pipette or syringe
- Inoculation loop
- Water
- Object slide

**General Procedure:**

Form, colour and size of spores are almost distinctive trait for classification of mushrooms.

Take a clear object slide and put a drop of water on it. Now use the inoculation loop to stir a few spores into the water. Put the object slide under the microscope to view the spores.

An other method is to put a drop of sporesolution from a sporesyringe on the object slide. If you use a sporesyringe we recommend to shake the syringe well to disperse the spores well in the water.

It is important the microscope be firmly fixed on a flat stable surface!
Preparation of Agar - Medium in Petri Dishes

The following formula makes 1 liter of "MEA" - malt extract agar medium, convenient for most species of cultivatable mushrooms. Especially for working with spores, antibacterial agar media is recommended. Ready to use formulas are offered, that only need to be mixed with water.

Recommended equipment:

- 20 g agar-agar
- 20 g malt extract
- 2 g dry yeast
- 1 g peptone
- 1 litre drinking water
- Erlenmeyer flask
- Sterile disposable Petri dishes or glass Petri dishes
- Measuring container
- Scale
- Parafilm
- Latex gloves
- Face mask and hairnet
- Disinfectant solutions for surfaces and hands
- Pressure cooker
- Sterile working area: Glove Bag/Glove Box or
- Sterile air flow (HEPA-filter, Laminar Flow Hood)

Mixing the substrate

Pour the ingredients into the Erlenmeyer flask along with hand-hot water, close the lid and shake well until mixed thoroughly. The maximum level of filling the flasks is reached at two-thirds of their volume. Remove the lid and wrap some aluminium around the flask's neck forming a tube which you bend down at its free end. This attached duct will ban condensate water to enter the unlocked flask during sterilisation.

Sterilisation of the agar medium

Agar medium should be sterilised for 45 minutes using a pressure cooker. Overlying a 2-3 centimetre water level at the bottom of the cooker a separating insert keeps the flasks above the water line. Assure yourself that there is no contact between water and the upright standing flasks, decant some water if necessary. (Mind the handling instructions given by manufacturers of your pressure cooker!)

Get the lid locked and put the cooker on a hotplate. Sterilise for 45 minutes, counting from the moment as the pressure gauge reaches its highest stage (for household pressure cookers). If you've got a professional
pressure steriliser at your disposal sterilise at 121°C / 259°F / 15 psi / 1.05 bar.

Attention: Do not exceed temperatures specified above for a longer span of time. By overheating the nutrients, the culture medium can degrade and the solutions colour darkens from yellowish to brownish. If so, the medium is useless. Substrates which are composed of other ingredients may have different colours.

After 45 minutes of sterilisation, let the cooker cool off in front of a HEPA-filter or in a clean place. During pressure equalisation air is sucked in; a clean and wet cloth over the cooker's cover filters the aspired air, if you do not use a HEPA-filter.

Pouring the Petri dishes

Wear protective clothing, disinfect working area and hands. Do not open the cooker before the pressure gauge indicates 0. Continue processing from now on because the agar medium is only in its liquid stage above a certain temperature. (If you work with glass Petri dishes, keep in mind, they have to be sterilised too.)

Pour about 25-30 ml warm agar-medium into a Petri dish with 90 mm in diameter, which gives 35-40 Petri dishes per 1 litre agar-medium. For cooling down leave them in a place of low microbiological contamination in front of a HEPA-filter or inside a Glove Box.

When the agar is hardened and cooled to room temperature, the Petri dishes are ready for inoculation. If you do not use all casted Petri dishes, you can seal up the remaining Petri dishes with Parafilm, wrap them in plastic foil or bag and keep them in a clean refrigerator for up to 4 weeks. (35.6-39.2°F / 2-4°C)

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Mycelium germination from spores

When growing mushrooms out of spores you obtain plenty of autonomous mycelia strands forming dikaryotic mycelium, a so called spore mass inoculation. This mycelium has sprung from various germinating spores, sprouting mushroom cultures comprise individuals, descending from different mycelia strands. (You can compare this mycelium to a fruit orchard - yielding heterogeneous fruits from different trees- not similar fruits from only one tree.) Multicultural mycelium is mainly used for selecting the fittest individuals from the new culture to continue work with them.

Recommended Tools:

- Spores (Sporeprint or Sporesyringe)
- Agar medium in petri dishes
• Oneway Inoculation loop or Needelholder with inoculation loop
• Parafilm to seal the petris
• Spiritus Lamp (only for metal inoculation loop)
• Facemask and Hairnet
• Latex gloves
• Workspace desinfection
• Handdesinfection
• Glove Bag (sterile workspace)

Inoculation of agar medium

To minimise the risk of contamination of agar medium by other organisms (e.g. bacteria, moulds, ...) we advise working in a Glove Box/Glove Bag or in front of a HEPA-filter. Clean the workspace, wash hands and forearms, put on a protective face mask, hairnet and gloves, then disinfect your worktop well. Disinfect hands again and allow drying before starting. Antibacterial agar has proven to be successful with spore prints gained from outdoor collected mushrooms, for those often carry bacterial contamination.

If working with a reusable inoculation loop, heat the inoculation loop red hot in the flame of a alcohol lamp and let it cool down in your hand. Do not touch the spore print, inoculation loop or agar medium. Now rub the spore print until the whole loop has gathered some spores. Open the Petri dish ajar, and import the spores to the agar drawing a "S" through the media. In case of inoculation with a spore syringe, 1-2 ml solution per Petri dish will suffice.
Do not take off the lid fully and work quickly to lessen contamination risks. Close the lid and seal it with Parafilm. It is advisable always to inoculate several Petri dishes with a spore print since they thrive and prosper varyingly.

Label the Petri dishes giving information about date, genus name, strain (strain means different type species within one genus - comparable with different kinds of apples) and consecutive number. A CD-marker, Edding-marker or permanent marker will stick to it.

Mycelium growth

During spawn-run (development and growing of the mycelium) the sealed Petri dishes are stored in a dark and neat place. The appropriate temperature depends on the genus cultivated. Ensure that the incubator in which the mycelium is grown provides enough ventilation. After a few days up to one week the spores start germination. As soon as rhizomorph mycelium strands become visible, they are ready for selection. (Look up the instruction for "Selection of mycelium strands").

Production of spore syringes

Spore syringes contain spores dissolved in water and are being used to inoculate substrates. Hobby-mycologists tend to work with spore syringes because even if used in a not 100% sterile environment, the substrates seldom contaminates.

It’s rather easy to produce small to medium amounts of substrates or grain spawn with spore syringes. If you inoculate substrates with a spore syringe, you get a "Multi-culture" (look up "Growing mycelium out of
spores"), which mostly result in less crop yield, compared to usage of selected rhizomorph mycelium strains.

**Recommended Tools:**

- Spore print
- Glasses (sterilisable!!)
- Scalpell with sterile blades
- Empty syringes and needles
- Latex Gloves
- Facemask and Hairnet
- Filter Disk
- Workspace desinfect - Bazillol
- Handdesinfect
- Water
- **Glove Bag (sterile workspace)**

We recommend using about 100 ml water and one spore print per glass. The lid of the glass needs a hole of about 1 cm in diameter; via this hole you will later fill the syringes. Fill the glasses with water (2/3 of the glass) and put the lid with the hole on during sterilisation. Wrap aluminium foil around the lid, sterilise the glasses and the lid without a hole (also wrap it in aluminium foil), for about 30 minutes. We recommend using a pressure cooker for sterilization.

Counting the sterilisation time from the moment, the pressure gauge reaches its highest stage (for household pressure cookers). If you've got a professional pressure steriliser at your disposal sterilise at 121°C/ 250°F/ 15 psi/ 1.05 bar.

Leave the cooker to cool out in clean place or in front of HEPA-filter after sterilization. You can put a clean wet piece of cloth over the cooker during the cooling process to filter the air streaming into the cooker if working without a HEPA-filter.
To keep contamination risk low, please work clean! Use a new, sterile skalpell blade for each spore print.

Open the lid as soon as the pressure has vanished. Wash and disinfect your hands and lower arms and use latex gloves. Store the glasses in a clean place (in front of a HEPA-filter or in a glove box). Proceed as soon as the glasses have cooled down to room temperature (less than 86°F or 30°C).

Before you start, please wash your hands, lower and upper arms with hot water and soap. Clean and disinfect your working space. Put on hairnet, face mask and latex gloves. Disinfect your gloves and wait till they're dry.

Use a scalpel to scrape the spores off the spore print into the water. Make sure not to touch the spores while holding the spore prints. After you have scraped the spores into the water, put on the lid (without hole) and shake the glass well. Change the lid to the one with the hole. Stick the syringes needle through the hole and fill the syringe. To avoid contamination, be careful not to touch the lid with the needle or needle with your hands.
We recommend packing the syringes airtight using a zip-lock bag. Stored in a dark and cool place (max. 20°C).
the spores will be viable for about one year (depending on mushroom species).

To test their ability to germinate, put a few ml (1 or 2 drops) on a Petri dish with agar medium. The mycelium will start to grow after a few days. (For detailed instructions kindly have a look on chapter: "Growing mycelium out of spores").

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**Mushroom Cloning**

Gaining new cultures out of a fresh mushroom involves asexual reproduction. A mycelium achieved through cloning is called "pure culture", it is genetically identical to the original mushroom. The successfully breeding of a mycelium out of spores on the other hand is the way of sexual reproduction the creation of a new organism with a new genetically code. When working with pure cultures, just one individual develops on the substrate, so there is no competition for nutrient elements. This will lead to a higher and well predictable yield with stable quality.

**Recommended Tools:**

- Hairnet and Facemask
- Latex Gloves
- Alcohol Lamp
- Scalpell with sterile blades
- Workspace desinfect
- Handdesinfect
- Petridishes with Agar-Medium
- Parafilm to seal the petris
- **Glove Bag (sterile workspace)**

**Inoculating the nutrient medium with a mushroom clone**

Only select the most vital and gratifying mushroom fruit bodies. If you are not able to make a clone immediately after picking, keep them neatly stored in the refrigerator for maximal 48 hours. Do not store a mushroom longer than absolutely necessary because it’s harder to gain germination of mycelium out of older fruit bodies and the risks of bacterial contamination increases.

As in every laboratory working step during the life cycle of mushrooms, clean and sterile working is essential for success! Put on face mask, hairnet and gloves; clean the working area in front of the HEPA-filter or the Glove Box in-depth and disinfect working area and gloves. If you intend to clone more than one mushroom, disinfect the working space, change gloves and put on a fresh scalpel blade (or flame it until glowing red and let cool down) before carrying on with a new fruit body.
Fruiting bodies are basically composed of compacted mycelium, thus flesh intended to clone can be won from every part of the mushroom. Most suitable are interior parts of the upper stem and cap. Split the near-ground part of the stem half a centimetre deep and tear apart the mushroom without touching the inlying flesh with your fingers.

Flame-sterilise the scalpel until glowing red over the alcohol lamp, let cool off and put on a sterile blade. For tissue harvesting we recommend to graft tissue from the most internal parts of a mushroom which provides greatest cleanliness and the lowest contamination risk. A piece of fruit sized 3x3 mm will suffice. Impale the small piece of flesh on the scalpel and transfer it onto agar medium. Seal the inoculated Petri dishes with Parafilm and shelve them in a dark place to stimulate the mycelium growth. The adequate temperature depends on the genus cultivated. A few days up to one week later the mycelium starts germination.

It has proved itself to inoculate several Petri dishes with internal mushroom grafts of the individual you wish to clone since the results sometimes strongly vary. Even under best laboratory conditions you will have to face failure rates at 10%. Amateurs and freshmen should bargain for failure rates around 25% or even more. Do not get discouraged, with a little practice in cloning you will amend quickly.

Label the Petri dishes giving information about date, genus name, strain (strain means different type species within one genus - comparable with different kinds of apple) and consecutive number. A CD-marker, Edding-marker or permanent marker will stick to it.

**Mycelium growth after cloning**

During the spawn-run (development and growing of the mycelium) the sealed Petri dishes are stored in a dark and neat place. The appropriate temperature depends on the genus being cultivated. Ensure that the incubator in which the mycelium is grown provides enough ventilation. After three to five days (depending on species) new mycelium filaments will start to grow out of the piece of flesh. As soon as rhizomorph mycelium strands become visible, they are ready for selection. (Look up the instruction for “Selection of mycelium strands”.)
Selection of Mycelium Strains

If you cultivate mushroom mycelium on agar medium there will appear different form of mycelium. The two main forms are: rhizomorph mycelium and fluffy mycelium (looks like cotton). For further cultivation and introduction of fruiting only the rhizomorph mycelium is suitable. The rhizomorph mycelium looks like the roots of plants. The primordia which later become fruit bodies are built from it. If you cultivate mushroom cultures on petri dishes, you have to select the fluffy mycelium from the rhizomorph. Only the rhizomorph growing mycelium is used for further cultivation.

Rhizomorph and fluffy mycelium strains on one petri dish. It was selected for one time before.

Recommended Tools:

- Hairnet and Facemask
- Latex Gloves
- Alcohol Lamp
- Scalpel with sterile blades
- Workspace disinfect
- Hand disinfect
- Petridishes with Agar-Medium
- Parafilm to seal the petris
- Glove Bag (sterile workspace)

Transferring rhizomorph mycelium

As soon as an entire Petri dish is overgrown with mycelium it should be proceeded. If you wait too long the fluffy mycelium outreaches and overgrows the rhizomorph shaped form and the Petri dish becomes unusable. As in every laboratory working step during the life cycle of mushrooms, clean and sterile working is essential for success! Put on face mask, hairnet and gloves; clean the working area in front of the HEPA-filter or the Glove Box in-depth and disinfect working area and gloves.
If you intend to clone more than one fruit body, scrap the used blade; disinfect the working space and change gloves. Flame-sterilise the anterior part of the scalpel over the alcohol lamp until it is glowing red, let cool down to room temperature and put on a fresh blade before carrying on. Do not get the mycelium in contact with hot tools!
Please be cautious about flame sterilising. Alcohol-containing disinfectants and gloves easily catch fire!

Choose a rhizomorph growing mycelium strain from the Petri dish and slice it into pieces measuring 3x3 mm. Skewer one piece with the blade and transfer it to a fresh Petri dish containing agar medium. Seal the Petri dishes with Parafilm, handle them with care for the piece of mycelium should not slip out of place!
Advice: It’s easier to distinguish between rhizomorph and fluffy growing mycelium, if you hold the Petri dish in front of a lamp.

It has proved well to inoculate several Petri dishes with pieces of the same mycelium, since the results can strongly vary. Even under best laboratory conditions you will have to face failure rates of 10%. Newcomers should not lose courage if they have to cope with failure rates up to 25% or even beyond.

Usually it is necessary to select a strain several times to get Petri dishes with rhizomorph mycelium only. Moreover the selected mycelium is able to mutate, for example grow fluffy again, and become unfit for utilisation.

Label the Petri dishes giving information about date, genus name, strain (strain means different type species within one genus - comparable with different kinds of apple) and consecutive number. A CD marker, Edding marker or permanent marker will stick to it.

The mycelium pieces are placed on petri dishes filled with agar medium.

**Mycelium growth after selection of strain**

During the spawn-run (development and growing of the mycelium) the sealed Petri dishes are stored in a dark and neat place. The appropriate temperature depends on the genus being cultivated. Ensure that the incubator in which the mycelium is grown gives enough ventilation. After three to five days new mycelium filaments will start to grow out of the piece you transferred. As soon as you have gained a Petri dish almost completely overgrown with rhizomorph mycelium, it is ready for inoculating grain spawn.
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Sterilising rye substrate for grain spawn

In mushroom cultivation, cereal substrate is being used to produce grain spawn. This production stage is mainly used to multiply mycelium mass, you get from the agar plate, for inoculation of fruiting substrate.

Recommended equipment:

- Rye grain
- Vermiculite medium
- Gypsum
- Autoclave Bags Unicorn type 3 T or
- Glasses with lids with a hole (1 cm in diameter) and filter disk
- Scale
- Bag sealer or strong adhesive tape
- Sieve
- Container for mixing
- Pressure cooker
Preparing the rye substrate

Soak the rye in 167°F/75°C warm water, allow the water level to be 4 - 5 cm higher and leave it overnight (12 - 18 hours). Put the soaked rye grain into a sieve and let it drain for around a quarter of an hour, then put it into the mixing container. Moisturise the vermiculite using the sieve, until entirely soggy, watch out not to soak it too much. Make sure that the vermiculite is even wet, but not as wet that water drops out of the sieve. Let it drain for a moment. Now mix the gypsum equally with the rye grain, then add the vermiculite and mix it again very well.

Mixing proportion of substrate

For 1 glass with volume of one litre we recommend to use 200 g (approx. 0.25 l) rye grain, 200 ml vermiculite medium and 1.5 g gypsum. This formula will result in 400 g rye grain substrate. Time needed to sterilise: 90 minutes.

If you work with Bags, for grain substrates we recommend to use original Unicorn Bags Type 3 T. Use for each bag 1.3 kg rye grain, 1.4 litre vermiculite and 8 g gypsum. This formula will result in 2.7 kg rye grain substrate. Time needed to sterilise: 3 - 4 hours.
Filling glasses with substrate

Fill the glasses up to two-thirds of their volume. For a one litre glass that will be about 400 grams of rye-vermiculite - substrate. The lids should be perforated (pierce a hole 1 cm in diameter) to ensure that fresh air is given to the mycelium. The filter disk attached to the lid prevents contamination. Do not screw down the lids too firm during sterilisation to ensure pressure compensation (and prevent the glasses from breaking).
Filling bags with substrate

Roll down the autoclave bag about 10 cm and pour in 2.7 kg of the grain substrate mixture. Be careful not to spill any substrate on the upper regions of the bag (in case you did, clean the bag with a wet piece of cloth). Then wrap the bag twice.

Sterilising the substrate

A pressure cooker is used for the sterilising process. Overlying a 2-3 centimetre water level at the bottom of the cooker a separating insert keeps the bags above the water line. Assure yourself that there is no contact between water and the bags, decant some water if necessary. (Mind the handling instructions given by the manufacturer of your pressure cooker!) Now load the glasses or bags.

If the cooker is big enough you can make two levels of bags. Place the upper layer on a separating tray over the left spare zones of the lower layer. This ensures that the steam gets evenly distributed.
Get the lid locked and put the cooker on a hotplate. Counting the sterilisation time from the moment, the pressure gauge reaches its highest stage (for household pressure cookers). If you've got a professional pressure steriliser at your disposal sterilise at 121°C/ 250°F/ 15 psi/ 1.05 bar. Once the sterilisation time has passed the cooker must cool down in a clean place, preferably in front of a HEPA - filter (sterile air flow). If working without laminar flow hood put a clean wet piece of cloth over the cooker during the cooling process to filter the air streaming into the pot while pressure equalisation.

After the cooker is fully depressurised, open the lid. If you work with glasses close the lid of the glasses fast and tight to minimise contamination risk. The glasses/ bags should cool down to room temperature in front of a HEPA-filter or in a Glove Box.

As soon as the substrate has cooled down bellow 30 ° C / 86 ° F, it is ready for inoculation. If your are up to continue at a later date close the bags / glasses tightly, store the substrates in the refrigerator (35.6-39.2°F, 2-4°C) and use them within 4 weeks.
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Inoculation of grain spawn with mycelium on agar medium

Recommended Tools:

- Petri dish (at least 3/4 colonised, not mutated)
- Sterilised rye substrate
- Scalpel with sterile blade
- Bag sealer or strong adhesive tape
- Latex gloves
- Face mask and hairnet
- Disinfectants for workspace and hands
- Sterile working area: Glove Bag/Glove Box or
- Sterile air flow (HEPA-filter, Laminar Flow Hood)

Inoculation

Perform this working step as aseptic as possible to prevent the grain from contamination by bacteria or mould. Clean your worktop, wash hands and forearms, put on a protective face mask, hairnet and gloves and disinfect your worktop well.

Use the mycelium of 1 Petri dish for inoculating 1 glass of sterilised grain (about 400 grams substrate), for substrate in bags take more petri dishes. Avoid inoculation of 1 grain substrate with different mycelia strains; use only copies of one clone per glass / bag.
Remove the Parafilm from a Petri dish only inside the Glove Box or only in front of a HEPA-filter. Take the scalpel and carve eight lines in star like array and a circle at half the diameter into the mycelium. Thereby you got 16 small pieces.

Unscrew the glasses or open the autoclave bags on their top. Spear the mycelium slice with the scalpel and transfer them carefully to the sterilised substrate. Close the glass / bag tight after this is done. Now distribute the mycelium pieces evenly by shaking the glass or bag, to achieve fast and equal colonisation. In case that mycelium pieces stick on the wall of the glass or bag, the can be released by knocking soft on the outside, to get again contact with the substrate.

**Mycelium growth after inoculation**

Store the inoculated substrate in a dark and clean place at convenient temperature for spawn run of this mushroom species. Ensure that the incubator in which the mycelium is places provides enough ventilation.

After a few days mycelium strands become visible growing out of the small agar pieces and colonise the grain. One or two weeks after inoculation the glasses and bags should be given a good shake to redistribute the already colonised matter amongst the unsettled material. This will accelerate the colonisation of the grain. Under convenient conditions rye grain should be fully colonised about 3 to 4 weeks after inoculation.

As soon as all rye grains are overgrown with white mycelium, the grain spawn is ready to be used for inoculation of the fruiting substrate (e.g. compost, straw, wood - depending on the mushroom species). Use 2 to 10 % of grain spawn for inoculation of fruiting substrate, according to mushroom species and type of substrate.
**Reproduction of grain spawn**

To produce more inoculation material you can use grain spawn to inoculate sterilised rye grain substrate. For optimum result use 10% of ready colonised grain spawn, based on the weight of the fresh rye substrate. Please make sure to perform this step under sterile conditions to prevent contamination.

Unscrew the glasses or open the autoclave bags on their top. Separate the grain kernels of the colonised spawn by shaking and plumping them repeatedly. The fresh rye substrate can now be inoculated with grain spawn. Close the glass / bag tightly after this is done. Now distribute the colonised grain evenly into the fresh substrate, by shaking the glass / bag, to achieve fast and equal colonisation.
For mycelium growth stage, store the inoculated substrate in a dark and clean place at convenient temperature (spawn run) for this mushroom species. Ensure that the incubator in which the mycelium is grown gives enough ventilation.

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Sterilisation of wood substrate

Most fungi won't develop fruiting bodies on rye grain substrate, that’s why an adequate fruiting substrate must be inoculated with the grain spawn. In this instruction we want to introduce a standard substrate, which is suitable for a wide range of wood habitant mushrooms.

**Recommended equipment:**

- Woodchips
- Saw dust large
- Gypsum
- Rye bran
- Water
- Autoclave Bags Unicorn type 14#
- Scale
- Bag sealer or strong adhesive tape
- Sieve
- Container for mixing
- Pressure cooker
Preparing the substrate

Let the wood chips soak in cold water overnight (12-18h). Use as much water until all the chips are floating. Put the soaked wood chips in to a sieve and let it drain for around a quarter of an hour. In the meantime put all dry ingredients (sawdust, rye brain and gypsum) into the mixing container and mix it very well. After the dry ingredients are mixed, add the soaked wood chips and mix the substrate again. To conclude, add the water and mix it again very well.

Mixing proportion

For filling of 1 autoclave bag, (please use the original unicorn bags type 14# for wooden substrates) you'll need 368 g wood chips, 735 g saw dust large, 31 g gypsum, 200 g rye bran and 950 ml water. This will produce approximately 2.5 kg substrate. Sterilisation time: about 3 - 4 hours.

Filling bags with wood substrate

Roll down the autoclave bag about 10 cm and pour in 2.5 kg of the wood substrate mixture. Be careful not to spill any substrate on the upper regions of the bag (in case you did, clean the bag with a wet piece of cloth). Then wrap the bag twice.

Sterilising the wood substrate

A pressure cooker is used for the sterilising process. Overlying a 2-3 centimeter water level at the bottom of the cooker a separating insert keeps the bags above the water line. Assure yourself that there is no contact between water and the bags, decant some water if necessary. (Mind the handling instructions given by the manufacturer of your pressure cooker!) Now load the bags. If the cooker is big enough you can make two levels of bags. Place the upper layer on a separating tray over the left spare zones of the lower layer. This ensures that the steam gets evenly distributed.
Get the lid locked and put the cooker on a hotplate. Counting the sterilisation time from the moment, the pressure gauge reaches its highest stage (for household pressure cookers). If you’ve got a professional pressure steriliser at your disposal sterilise at 121°C/ 250°F/ 15 psi/ 1.05 bar.

Once the sterilisation time has passed the cooker must cool down in a clean place, preferably in front of a HEPA - filter (sterile air flow). If working without laminar flow hood put a clean wet piece of cloth over the cooker during the cooling process to filter the air streaming into the pot while pressure equalisation.

After the cooker is fully depressurised, open the lid. If you work with glasses close the lid of the glasses fast and tight to minimise contamination risk. The bags should cool down to room temperature in front of a HEPA-filter or in a Glove Box. As soon as the substrate has cooled down bellow 30 ° C / 86 ° F, it is ready for inoculation. If your are up to continue at a later date close the bags tightly, store the substrates in the refrigerator (35.6-39.2°F, 2-4°C) and use them within 4 weeks.

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**Inoculating wood substrates with grain spawn**

Most fungi won’t develop fruiting bodies on rye grain substrate, that’s why an adequate fruiting substrate must be inoculated with the grain spawn. This method is suitable for most wood habitant mushroom species.

**Recommended equipment:**

- Grain spawn, ready colonised
- Sterilised wood substrate
- Bag sealer or strong adhesive tape
- Latex gloves
- Face mask and hairnet
- Disinfectants for workspace and hands
- Sterile working area: Glove Bag/Glove Box or
- Sterile air flow (HEPA-filter, Laminar Flow Hood)
Inoculation of wood substrate

Perform this working step under aseptic conditions to prevent the grain from contamination. Clean your worktop, wash hands and forearms, put on a protective face mask, hairnet and gloves and disinfect your worktop well.

Open the sterilised wood substrate bag. Shake Separate the grains of the colonised spawn by shaking and plumping them repeatedly. Use 2 to 8 % (of the weight) of grain spawn for inoculation of wood substrate.

Add about 50 - 200 g of grain spawn per 1 bag containing 2,5 kg of wood substrate. Close the inoculated substrate bag using a bag sealer or strong adhesive tape. Now distribute the colonised grain evenly into the fresh substrate, by shaking the bag, to achieve fast and equal colonisation.

Mycelium growth on wood substrate

For mycelium growth stage, store the inoculated substrate in a dark and clean place at convenient temperature (spawn run) of this mushroom species. Ensure that the incubator in which the mycelium is grown provides enough ventilation. After about 2 - 3 weeks the mycelium should have grown through the bag and the substrate should be overgrown by white mycelium. (Please note that some different species of fungi could have different mycelia colours.) Now the mycelium is ready for the fruiting phase.

Laying of a mushroom bed

Preparing a mushroom bed with wood inhabitant mushrooms is a very easy thing! The best time to start is spring, as soon as the nights are frost-free. We recommend the use of spawn on wood basis (spawn describes a substrate, which is fully colonised by mushroom mycelia, used for inoculation of the fruiting substrate). The usage of grain based spawn may attract mice, rats or other vermin. Just mix the spawn with an convenient
base material and keep it moist.

Depending on the species of mushroom and weather conditions the mycelia often develop their first fruiting bodies only a few months after the inoculation. The mushroom fruits until all nutrients have been consumed. With little luck, the mushroom will settle permanently in your garden.

Recommended equipment:

- Completely colonised wood substrate (spawn)
- Wood chips
- (for 1 autoclave bag with 2,5 kg spawn we recommend 15 kg wood chips)
- Covering material (bark mulch approximately 25 litres, straw or soil)
- Corrugated card board
- Spade or shovel
- Water (garden hose)

Bed preparation

Mushrooms breeding in your garden need a shadowy place, preferably either near trees or underneath bushes. If you want to lay several beds side by side, leave enough space between the beds. With proper nurture they will expand and develop fruits for several years.

With one spawn bag (2,5 kg capacity) a mushroom bed of 80 x 80 cm can be inoculated. Excavate about 10 cm of soil and spread out cardboard as a bottom layer of your bed. Now disperse one half of the wood chips evenly on the bed and irrigate them for about 10 minutes using a hosepipe.
Inoculating the bed

The spawn bag needs to be properly shaken because mycelium populated wood substrate tends to be closely clotted. By fluffing and rubbing of the bag with the whole palm of your hand, the substrate can be separated. Make sure you separate the substrate thoroughly to ensure a consistent and quick colonisation of the wood chips.

Now spread out the spawn over the watered wood chip layer as evenly as possible and cover it with the remaining wood chips. Afterwards the mushroom bed needs to be watered again for about 10 minutes. To prevent the bed from drying out we recommend a 5 cm thick cover layer of bark mulch or straw. This cover layer needs to be moisturised as well.

Some mushrooms even allow you to use a cover layer made out of soil. We recommend using mushroom casing soil. Fluff up the soil in the bag, evenly spread out a 5 cm thick layer over the bed and water the bed for a few minutes.
Further care

Check the moisture of the mushroom bed periodical. If the bed isn't moist under 3 cm depth or more, please water it again. During the harvesting season we recommend to harvest the fruiting bodies daily. The simplest method to do this is twisting the fruiting bodies on their base. Take care to remove the whole shaft to prevent bacterial contaminations.
Wintering and feeding

To ensure your mushroom bed survives the winter, we recommend spreading out a 5 cm thick layer of wood chips before the first frost. This new layer offers your mushroom bed fresh nutrients. In the next spring, as soon as the nights are frost-free again, the mushroom bed should be controlled for moisture and be watered in case it dries out.

Fighting snails

Snails love mushrooms! To prevent these voracious creatures from destroying the whole crop, we recommend building a snail fence around the mushroom bed. Don't use slug and snail bait or other chemical pest control substances, the poison might end up in the fruiting bodies!
Inoculation of wood logs with spawn dowels

The inoculation of wood logs or stumps with spawn dowels can be done throughout the whole year, if the logs / stumps are stored frost-free during spawn run, until they are fully colonised. Depending on the species, the mushroom fruits for several seasons until all the nutrients of the wood have been consumed.

Recommended equipment:

- Wood logs or stumps
- Wood saw
- Tub for soaking
- Drilling machine and 9 mm (0,35 inch) drill
- Spawn dowels (wood dowels, fully colonised with mycelium)
- Jute bag
- Sealing wax
- Hammer

Preparations of log

The quality of the wood is crucial for successful cultivation. After you have cut the wood, make sure to store it in a dry place for 2 - 3 weeks, then prepare it as follows:

Soak the entire log for 3 days in a tub and leave it to dry on a canvas outdoors for one day. The primary choices of material are wood logs with bark, with 20 - 35 cm (7 - 14 inch) in diameter and 90 - 120 cm (35 - 47 inch) long.

After it’s deliverance the spawn dowels should be left in rest 2 to 3 days at room temperature (maximum 29 °C / 84 °F) to give the mycelium time to recuperate from it's journey. If you don't plan to use the spawn dowels immediately after the recuperation, please store in the fridge at 2 - 4°C/ 36 - 39°F and use it within a few weeks time.

Inoculating the logs

Cut off about 2 cm on each end of the trunk directly before inoculation to prevent unwanted fungal growth and contamination and throw the pieces away. Now drill about 50 holes of 3 - 4 cm (1,2 - 1,6 inch) depth all around the log evenly. Take care to work slowly, if the wood heats up too much it might affect it's quality! Now place the dowels into the holes carefully. Take care not to injure the mycelium. We recommend to inoculate the cut surfaces too, to reach even better results.
For logs we recommend to use about 50 spawn dowels, for stumps 30 - 50 spawn dowels. As soon as the whole log is inoculated, close the holes with sealing wax. The simplest method is to apply warm, liquid wax with a paint-brush and immerse the cut ends.

Mycelium growth at log

For mycelium development / spawn run, wrap the trunks in moist jute bags and put them in a shadowy place in your garden or in a well ventilated cellar for about 10 weeks. The jute bags need to stay moist. The spawn run phase is over as soon as white mycelium can be seen besides the holes. (Recommended temperature: spawn run - depending on species)

Setup in the garden and further care

As soon as the logs are fully colonised, dig a hole of 15 cm (6 inch) depth in a shady place in your garden and place the log in an upright position. For cultivation on a shady balcony or terrace use a flower pot filled with sand or pebbles. Keep the wood and the soil around it moist and water them on a periodical. The fruiting bodies develop during the season, providing the natural weather/fruiting conditions - depending on the species.

Wintering of log

To protect the logs against frost just wrap them in jute bags during winter. In spring time, bags are removed and the logs are sprayed with water.
Fighting snails at log

Snails love mushrooms! To prevent these voracious creatures from destroying the whole crop, we recommend building a snail fence around the log. Don’t use slug and snail bait or other chemical pest control substances, the poison might end up in the fruiting bodies!

Special tips for Lentinula edodes (Shiitake)

Shiitake doesn’t need contact with soil. The logs also can also be placed and fixed at a fence. We recommend using wood logs (with bark) of about 70 - 120 cm (27 - 47 inch) length and a diameter of about 15 - 20 cm (6 - 8 inch).

To start the fruit cropping prepare the logs as following: Dunk them in cold water for approx. 24 h (the log should be complete covered with water). The best yield can be made if the water has a ph value of 5 (to adjust the ph value use 0,1 % N hydrochloride). After dunking, pitch the log for 3 times on a stone plate. Now it takes 10-14 days for the pins (mini mushrooms) to appear. After harvesting, let the log rest for 6 weeks then you can dunk and pitch it again!

Mushroom cultivation on a bale of straw

Several mushroom species are straw inhabitant. You can use wheat, rye or barley straw. One of the most successful ways for these species is the cultivation on bales of straw in the garden.

Only use dry and healthy bales of straw, because the quality of the fruiting substrate always has a big influence on the crop yield. The colour of the straw (golden yellow) and the almost tear-proof blades indicate the health of the straw. Furthermore it should smell fresh, if it doesn't, don't use it, a musty smell either comes from mould or other fungi which are already populating the bale. Musty bales are not suitable for mushroom cultivation!

Recommended equipment:

- Bale of straw (27cm x 20cm x 40cm)
- Tub for soaking
- Grain or wood spawn (completely colonised)
- Jute Hessian Cloth (200 x 100 cm)
- String (2 m)
- Water
Preparations of a bale

Soak the bale in water overnight (12 -16 h) before inoculation. Take care that the whole bale is covered with water. Immediately before the inoculation take the bale out of the water and drain the spare water for half an hour.

Inoculation of a bale

Please wash your hands and arms thoroughly before you touch the spawn. For one bale of straw (27cm x 20cm x 40cm) we recommend the use 1 liter spawn. To assure a consistent population form one 5 -10 cm (2 - 4 inch) deep hole on each side. Use a clean stick to drill the holes. Divide the 1 liter spawn evenly on the 6 holes.

To keep the spawn in the bale and ensure that it grows through it, close the inoculated holes with straw from the outside. Now wrap the bale in the jute fleece and tie the string around it.
Mycelium growth on a bale - Spawn run

For spawn run store the bale in a shady place in the garden. Depending on the species, temperature and humidity, it will take 2 - 4 weeks till the bale is fully colonised with mushroom mycelium.

Control the humidity in the bale periodically. Humidify the bale again, if more than 3 cm of the outmost layer are dry. Please apply only small doses of water, because the spawn could die if the bale gets too wet. Depending on the weather it will be sufficient to use 2 - 3 litre per bale 1 to 3 times a week. Control the humidity inside the bales with your hand. Do this on a regular basis and adjust it with small amounts of water to prevent the spawn from drowning.

Fruiting of a bale

As soon as the bale is completely colonised, you can initiate the fruiting by increased air supply. Just remove the jute fleece on one broad side of the bale. If the weather conditions are right, the first pinheads should show up after 2 - 4 weeks.

The mycelium will fruit in several flushes until all the nutrients in the bale have been consumed. Afterwards you can still use the bale as a commodity for composting. Take care to harvest all the fruiting bodies. Please check the humidity in the bales during the harvest periods and also adjust the humidity if necessary.

Fighting snails at bale

Snails love mushrooms! To prevent these voracious creatures from destroying the whole crop, we recommend building a snail fence around the bale. Don't use slug and snail bait or other chemical pest control substances, the poison might end up in the fruiting bodies!

"PF-technique"

The PF-technique aka BRF-Tech (Brown Rice Flour technique) is a method developed by hobby mushroom cultivators for growing mushrooms in the simplest way. Over the last centuries many different versions of this method have developed. The following instruction is based on our experience.

Mushrooms need a convenient substrate to develop fruits. The substrate has to be produced under sterile conditions to avoid contamination through mould or bacteria. Contamination destroys not only the fungi but also the substrate. The substrate is inoculated with spores. In the next phase, the so called spawn run, the mycelium grows on the substrate. As soon as the substrate is fully colonised with mycelium, it is ready for the
fruiting phase.

**Recommended materials:**

- Micro-Boxes or PF-glasses
- Measuring cup
- Vermiculite
- Brown rice flour
- Spore syringe (ATTENTION, not every mushroom species is suitable for cultivation on PF-substrate.)
- Fruiting chamber
- Pressure cooker
- Container for mixing
- Water

**Mixing the PF substrate**

Blend one litre (about 700g) of rice flour with three litres of vermiculite medium, then add one litre of water and mix again. That should result in five litres of PF-substrate for 10 micro-boxes with 500 ml each.

**Filling the substrate**

Use your hands to fill the substrate into the boxes or glasses. Use your fingers to push the substrate into form to eliminate any hollow spaces, but don't press too much. Fill the boxes or glasses up till 1,5 cm under the edge of the box remains free, and smoothen the surface of the substrate. Clean the edge of the box or glass with a wet piece of cloth, and fill the rest with dry vermiculite. The dry vermiculite acts as a filter to prevent growth of contamination from the outside into the substrate. Close the boxes/glasses. If you are using micro-boxes remember to make sure the lid is lying loose on the box to ensure pressure balance. If you using glasses pierce the lid four times (make holes of about 2 - 3 mm / 0,1 inch in diameter), these will later be used to inoculate the substrate.

**Sterilise the substrate**

A pressure cooker is used for the sterilising process. Overlying a 2-3 centimetre water level at the bottom of the cooker with a separating insert keeps the boxes / glasses above the water line. Assure yourself that there is no contact between the water and the boxes / glasses, decant some water if necessary. (Mind the handling instructions given by manufacturers of your pressure cooker!) Now fill in the glasses or boxes. If the cooker is big enough you can make two levels. Place the upper layer on a separating tray over the left spare zones of the lower layer. This ensures that the steam gets evenly distributed.

Get the lid locked and put the cooker on a hotplate. Start counting the sterilisation time as, the pressure gauge
reaches its highest stage (for household pressure cookers). If you've got a professional pressure steriliser at your disposal sterilise at 121°C/ 250°F/ 15 psi/ 1.05 bar.

Once the sterilisation time has passed the cooker must cool down in a clean place, preferably in front of a HEPA - filter (sterile air flow). If working without laminar flow hood put a clean wet piece of cloth over the cooker during the cooling process to filter the air streaming into the pot while pressure equalisation.

After the steriliser is fully depressurised, open the lid. The glasses/ boxes should cool down to room temperature in front of a HEPA-filter or in a Glove Box. As soon as the substrate has cooled down bellow 30 °C / 86 ° F, it is ready for inoculation. If your intend to continue later close the boxes / glasses tightly, store the substrates in the neatly clean refrigerator (35.6-39.2°F, 2-4°C) and use them within 4 weeks.

**Inoculation of the substrate**

Perform this working step as aseptic as possible to prevent the substrate from contamination by bacteria or moulds. Clean the worktop, wash your hands and forearms, put on a protective face mask, hairnet and gloves and disinfect your worktop well.

Give the spore syringe a good shake to ensure that the spores are well spread throughout the water. If using micro-boxes you can pierce the lid with the syringe (please disinfect the spot you choose to pierce). The substrate glasses will be inoculated through the four holes in the lid. If you use ready sterilised PF-substrates please remove the tape from the holes on the lid before inoculating the substrate and leave the holes open afterwards, to ensure sufficient air exchange!

Remove the protective cover from the cannula just before inoculation. You mustn't touch the sterile needle. Stick the needle through the holes of your box or glass towards the wall and inoculate the substrate, spreading the liquid along the wall of the box. Use 1 - 4ml of the spore-water mixture per each box/glass (filled with 500ml substrate), portioned in all 4 holes.

Should the needle touch anything unsterile, you will have to sterilise it again. Therefore hold the nip of the needle into a flame (Bunsen burner or lighter) till the nip turns red and let it cool down again. (Do not overheat the needle as the stand is made of plastic which could melt!)
Mycelium growth PF

After all substrates have been inoculated, they should be stored in a warm (up to 30°C) and dark place. The substrate is ready for the next step as soon as the whole box / glass is grown through with white mycelium (this normally takes 2 - 3 weeks). Only the 1,5 cm layer of dry vermiculite stay free of mycelium.

Fruiting

Rub off the layer of dry vermiculite from the top of the boxes/glasses and take out the mycelium. Put the mushroom mycelia into a growing chamber or similar under the convenient environmental conditions for "the Primordia formation". As soon as the first small mushrooms (Primordia) appear change the temperature and humidity to the recommended fruiting conditions. According to the species, it takes about 1 or more weeks untill the Primordia appear, a few days later you can harvest your first own mushrooms.

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Inoculation of substrat bags with sporesyringes

This is a very simple method of mushroom cultivation and suitable for hobby-mycologists. Use a convenient substrat depending on the mushroom species you want to cultivate. Detailed information about the convenient substrate can be found in the product description of our spores. When you bring spores onto an appropriate nutrient medium, the spores start germination. As soon as the substrate is fully colonised by the mushroom, you can set up the bag for fruiting.

Recommended materials:

- Substratbag
- Spore Syringe
- Workspace Disinfection
- Kitchen paper
- Tape (cloth tape)

Disinfect the surface of bag

To avoid invasion of any contamination during inoculation, we recommend to disinfect the surface (just a few cm large - the place you want to put the needle in). Kindly spray disinfection (i.e. Bacillol) on the bag, let it react for about 20 - 30 seconds, then dry it with a clean kitchen paper or similar.
Inoculation bag with syringe

Shake the syringe to dispense the spores equally. Now put the needle into the bag (at the disinfected area) and push the sporesolution into the bag. We recommend to use about 5 ml - thats 1/2 syringe - for small bags (2,5 l content). For larger bags (4,5 l content) we recommend to use 10 ml sporesolution - thats 1 spore syringe.

ATTENTION:
If the needle get in contact with any unsterile thing, you have to sterilize it. There for heat the forefront of the needle with a alcohol lamp (or with a lighter). The forefront of the needle should glow red. After that let the needle cool down for a few seconds.

Seal the inoculation area and distribute the spores

Close the inoculation area immediately with the tape. To distribute the spores equally in the substrate, shake the bag careful.

Spawn run in bag

For colonisation of the substrate, store the bag at the convenient spawn run - temperature (see in the product description in a dark place. After the substrat is fully colonised by the mushroom, you can put it into fruiting. If you work with rye grain substrate it is also possible to use the grain for inoculation of a different fruiting substrate.

TIP: If the substrat is not colonised even, kindly shake the bag after a few days.

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Instruction for indoor mushroom propagator

For successful growth mushrooms need suitable substrate, the right temperature and humidity, as well as oxygen and a little light. Our grow-kits are especially designed to provide these cultivation parameters in an easy to handle way.

It’s easy to upgrade a customary greenhouse into a hobby-mushroom-grow-set. The main principle always stays the same, no matter how much space you cultivate, only the machinery used to regulate the climatic conditions gets more complex, the more space you occupy.

Recommended equipment:

- Greenhouse
- Digital temperature control
- Electric heat pad or heating cable
- Humidity/CO2 Apparel Set
- Perlit
- Spray bottle
- Disinfectant

Main principle

Throughout their different stages of development fungi need a variety of environmental conditions. During mycelium growth most mushrooms need relatively high temperatures (27 - 29°C), during fruiting they need high humidity.

The electric heat pad or the heating cable is used, to provide the right temperature. To set the suitable temperature for each mushroom species, the electric heat pad or cable will be triggered by the digital temperature control. The humidity will be the result of humidity or CO2 pump, which is also supplying oxygen, and the wet perlit on the floor of the greenhouse.

Use as Incubator

Inoculated substrates have to be kept in clean place, under suitable conditions, during mycelium growth. Installing the grow-set for mycelium growing stage:

Clean and dark spaces are ideal for setting up your grow-set (you may as well cover the greenhouse with opaque material). If the set is stored in a cupboard make sure it gets enough oxygen. Open the cupboard at least once a day.
Place the heating pad under the greenhouse. If possible put some heat isolating material beneath the pad. If you are using a heating cable make sure it is lying snake-wise on the floor of the greenhouse, try to spread it symmetrical over the floor.

Place the sensor for the temperature control system on the floor of the greenhouse. Plug the heat-pad or cable into the temperature control and plug the control into a socket.

Take one of the pumps silicon tubes and connect one end to the hole of the greenhouses lid and the other to the pump. Keep the pump running at all times, as it helps the ventilation during the "spawn run" phase. The knob above the connection point regulates the amount of air. If you are using a tube-micro filter, cut the pipe open and install it in the middle section.

Adjust the system to the necessary conditions for mycelium growth of your fungi genus. Try to keep the greenhouse as dark as possible during this phase (except for your daily control).

### Use as fruiting chamber

As soon as the whole substrate is grown through with mycelium, the environmental conditions have to be changed to initiate the fruiting phase. The basic structure of the greenhouse stays the same as in the growth phase, the Humidity/CO2 pump as well as perlit will also be needed.

Moisten the perlit in a sieve or a plastic bag and spread it symmetrically on the floor of the hothouse. The perlit has to stay wet during the whole fruiting phase. Evaporated water can be refilled using a spray bottle. Substrate grown through with mycelium - blank or in opened bags - can be place directly on the perlit.

Installing the humidifier: First connect both of the silicone tubes to the hole in the lid of plastic box, one of them stuck about 1 cm through the hole, the other about 4-5 cm. The tube, stuck 4-5 cm through the hole, has to be connected to the ceramic diffuser. If you use an additional micro-filter connect it to the same tube as the ceramic diffuser.

Fill the plastic box with fresh tap water till ¾ of the volume are full and close the lid. Important: The ceramic diffuser has to be completely under water, the second tube must hang in the air above the water level.

The last step is to connect the tube, attached to the ceramic diffuser, to the air pump and stick the second pipe into the greenhouse. The button above the pumps connection regulates the amount of air, enabling us to control ventilation and humidity inside the hothouse. Change the water every 2-3 weeks. Adjust the system to the necessary conditions for mycelium growth of your fungi genus.

Adjust the system to the necessary conditions for fruiting of your fungi genus.