Survival of honey fungus in wood and bark chip mulches

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describe the results of a study undertaken at RHS Garden Wisley to assess the risk of honey fungus infection from timber-derived mulches

Howard Rice / GPL

The pale brown fruiting bodies of *Armillaria mellea* give rise to its common name of honey fungus and their appearance in the garden can give cause for concern, especially if nearby plants are dying

ARMILLARIA ROOT ROT is one of the most serious diseases affecting woody plants in gardens in the UK. It is commonly known as honey fungus because of the honey-coloured fruiting bodies that are produced during autumn. Gardeners also refer to it as the bootlace or shoestring fungus because *Armillaria* spreads through the soil via rhizomorphs (cords of fungus mycelium) that resemble bootlaces or plant roots. Honey fungus is mainly confined to the underground parts of plants and can be confirmed by the presence of the creamy-white mycelial sheets between the bark and wood of infected roots or at the collar of the plants (Greig and Strouts 1983). The symptoms observed above ground include some or all of the following: reduction of growth, premature autumn colour, dieback of the crown or branches, stress-induced reproduction, exudates of resin or gum on basal stems, and eventually the death of the plant (Morrison *et al* 1991). The disease spreads to new hosts by root contact or via rhizomorphs. There is no effective chemical treatment for *Armillaria* and recommended control involves the removal and destruction of the infected stumps and as much of the infected root system as possible.

With the increase in recent years of the practice of mulching, many gardeners are concerned that this could encourage the disease. Mulching usually involves the spreading of wood- or bark-chips around the base of plants for the purposes of suppressing weeds, reducing the evaporation of soil moisture and regulating soil

La Montagne / SPL

Heather Angel

Organic mulches derived from bark (left) and wood (right) are widely used to conserve soil moisture and reduce weed growth in domestic and amenity horticulture. The growth and behaviour of honey fungus in these mulches and the subsequent risk of plant infection has now been assessed

temperature (Webber and Gee 1996). Bark-chip is usually regarded as more ornamental than wood-chip. Mulch that is available commercially should have been composted on an industrial scale and as a result would have reached temperatures of 70°C, sufficient to kill pathogens including *Armillaria* (Yuen and Raabe 1984) and the source material would, in any case, be unlikely to be infected. Material that is generated and used in the garden has the greatest potential to contain the fungus.

Tim Sandall

Landscape contractors are encouraged to set up green waste management and recycling operations and tree surgeons often chip as much wood as possible. These materials are sometimes used as mulch on site in order to reduce bonfires or transport and disposal costs. This has raised the questions of whether chipped material could be a source of the disease, or its use as mulch could increase the risk of honey fungus infection.

The primary aim of this study (Pérez Sierra 2003) was therefore to investigate the growth and behaviour of *Armillaria mellea* in wood- and bark-chips and determine whether infected chipped material could act as a source of infection when used as mulch.

Methods and results

Two glasshouse experiments were designed to study the growth and behaviour of *A. mellea* in wood- and bark-chips of *Pinus sylvestris* (Scots pine), and two field experiments were set up to study the effect of mulching on *A. mellea*-infected plants, and whether *A. mellea*-infected chipped mulch could infect healthy plants.

Two signs indicative of honey fungus infection include creamy-white mycelial sheets between the bark and wood of roots (left) and black rhizomorphs in the vicinity of infected plants (right)

Tim Sandall

Growth and spread of *Armillaria mellea* in mulches

The glasshouse experiments were carried out in containers filled with soil and topped up with either a 10cm or 7cm layer of mulch (photograph p206). The mulch was inoculated with *A. mellea* by introducing fragments of infected wood ➤

Photographs: RHS Pathology Department

Experiments conducted under glass found that honey fungus can spread and survive in wood- and bark-chips, even when severed from the inoculum

Two experiments were performed on *Rosa laxa*.. The application or withholding of mulch was found to have no effect on the survival of already infected plants – all were killed. Conversely, the application of infected mulch to healthy plants resulted in 2.5 percent of the plants coming down with honey fungus

(inocula). These consisted of portions of *Corylus avellana* (hazel) wood that had been artificially inoculated with *A. mellea*. Different inoculum sizes of 1.5, 2.5 and 5cm long by 1.5cm diameter respectively were used.

The first experiment was set up to find out whether *A. mellea* could spread through and colonise organic mulches. It revealed that *A. mellea* grew well in both wood- and bark-chip mulch although there was high variability in the results obtained. The rhizomorphs that were produced ranged in length from 1 to 85cm. There was no significant difference in colonisation of wood-chip or bark-chip mulch when the layer of mulch was 10cm thick. Nor was there a significant difference in the rate of colonisation by the different sized inocula.

The second experiment was set up to determine whether rhizomorphs of *A. mellea* could survive and grow in the mulch after being severed from their inoculum. After 12 months the rhizomorphs from each container were harvested, measured, oven dried at 70°C for 48 hours and weighed. When the inoculum was removed from the containers the severed rhizomorphs carried on growing in most of the mulch treatments even though they were no longer attached to their original food base. Interestingly, when a thinner (7cm) layer of mulch was used there was a significant difference in rhizomorph growth – they grew well within wood-chips but completely dried out in bark-chips.

Effect of mulching on *Armillaria mellea* infection in the field

Rosa laxa rootstock plants in pots were artificially infected with *A. mellea* before four different treatments were applied: pine bark-chips, pine wood-chips, gravel or no mulch (photograph above). The mulch was free from *A. mellea*. The growth and vigour of the plants were measured for three years. A chlorophyll meter was used to measure the amount of chlorophyll present in the leaves of the plants during this time, as this is widely accepted as a measure of plant vigour. The plants were removed from the experiment when more than 75 percent of the stems were dead, and the inocula were recovered and checked for viability.

The plants grew to similar heights and the weight of pruned stems was similar for all the treatments, but every year these parameters declined. After three years, mulching with wood-chips, bark-chips and gravel had no effect on the infection process and *A. mellea* killed plants irrespective of their mulch treatment. There were no significant differences between the treatments.

Evaluation of the risks of using *Armillaria mellea* infected mulch material in the field

This experiment evaluated the risk that *A. mellea* infected mulch could pose to healthy plants. The roses were healthy and only the bark-chip mulch was inoculated with *A. mellea*. Two different inoculum sizes were used: 1 or 5cm long fragments by 1.5cm diameter. The inoculum was either buried in the bark-chip mulch layer close to the plant, at a distance of 5cm, or buried in the bark-chip mulch near the edge of the pot, at a distance of 15cm. Two different mulch layer depths were used, 7 and 10cm.

Honey fungus can colonise timber-derived mulches by rhizomorph migration but the likelihood that plants will then get infected is low

A cross-section of *Rosa laxa* roots taken near the crown shows an area of discoloration caused by honey fungus infection

After 14 months, only 4 percent of the 1cm inocula had survived in comparison to 20 percent of the 5cm inocula. Only 4 percent of the pots contained rhizomorphs and all were produced from the 5cm long inoculum. The fungus infected only 2.5 percent of the inoculated plants. These infected plants had all been inoculated with the 5cm inoculum placed close to the plant.

Conclusions

From the experiments it is possible to conclude that:

- *A. mellea* can spread and survive in bark- and wood-chip mulches. Rhizomorphs used the wood- and bark-chips as a food base, and this was confirmed by observation of the colonisation of mulch pieces. Mycelium was found in wood- and bark-chips and several pieces were linked together by rhizomorphs (photograph above).
- Infected plants died at a similar rate irrespective of whether they were mulched with gravel, wood- or bark-chips or not, and so mulching had no effect on the infection process of *Armillaria.*
- The risk of infecting healthy plants by using mulch containing *A. mellea* was measurable, but low.
- If infected material is chipped into small fragments it is less likely that *A. mellea* will survive.
- Inoculum placed close to the plant is more likely to cause infection.
- A small piece (5cm long by 1.2–1.5cm diameter) of infected material with *A. mellea* can survive buried in the soil for at least three years.

If honey fungus is already present in the garden, the risk of infection is not increased by using clean commercial mulch, because the fungus spreads no more readily in the mulch than it does in the soil. However, if gardeners chip their own woody material to use as mulch they should be very careful to choose only material that is free from honey fungus, because there is a small but measurable risk that even fragments of contaminated wood can infect plants. All parts of plants affected by honey fungus should be destroyed by burning or removing to land-fill, including as much of the root system as possible.

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