Factsheet 11/07

Mushrooms

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Mushroom Virus X (MVX) prevention

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This factsheet is a summary of the most important information currently available. Its objective is to provide guidance on the recognition, prevention and control of the disease.

Introduction

Mushroom Virus X (MVX Figure 1) was first recognised on British farms in the late 1990s. It reached a peak in the early 2000s, at which time a substantial proportion of the industry was affected. In the harsh trading conditions that prevailed the disease was a major factor in causing many of the farm closures that subsequently occurred. MVX has been the most costly and damaging disease of the late 20th Century.

While control of the disease appears to have been largely successful, sporadic outbreaks still occur. These, together with our imperfect understanding of the exact nature, origin and to some extent diagnosis of the disease make it still a serious potential threat to mushroom production.

1 MVX delays or suppresses pinning, leading to bare areas and reduced yield

How MVX is spread

Mushroom Virus X disease, as the name implies, is a viral disease of unknown origin and nature.

- Transmission of the virus(es) occurs by anastomosis, the naturally occurring connections between infected and healthy (recipient) mycelium.
- There is no external carrier (vector) of the disease.
- Passage of the disease from infected to healthy crops is by microscopic mushroom spores, tiny mycelial fragments from bulk spawn-run compost and residual mycelium.

The amount of infected material required to effect transfer of disease from infected to healthy mycelium has been shown to be incredibly small but the rate of movement from a point of infection at spawning is at least 2.5 m (5 m diameter) by the first flush.

Transmission can take place at any point throughout compost preparation and cropping but the opportunity for transfer is far greater at certain times and with some specific processes. The major sources of potential infection are from MVX infected mushroom spores and mycelial fragments from fully spawn-run bulk phase III compost and un-cooked out crops at emptying.

The majority of serious and persistent MVX outbreaks have been associated with bulk phase III compost production. It would appear that this process combines both maximum opportunity for contamination and maximum potential to produce inoculum once it is itself infected.

However, it is clear that disease development is not dependent on the production of bulk Phase III compost as MVX has been found on a number of farms with various combinations of site layout and production methods, including non-bulk phase III farms.

Symptoms

Currently there appear to be at least two main strains or combinations of virus and/or symptoms. They are firstly MVX-PD causing pinning disruption (Figures 1, 2 & 3) with consequent further symptoms and secondly MVX-BS causing brown symptoms where mushrooms in a white crop develop distinct brown, cream or off white coloration (Figures 6 and 7).

MVX – pinning disruption

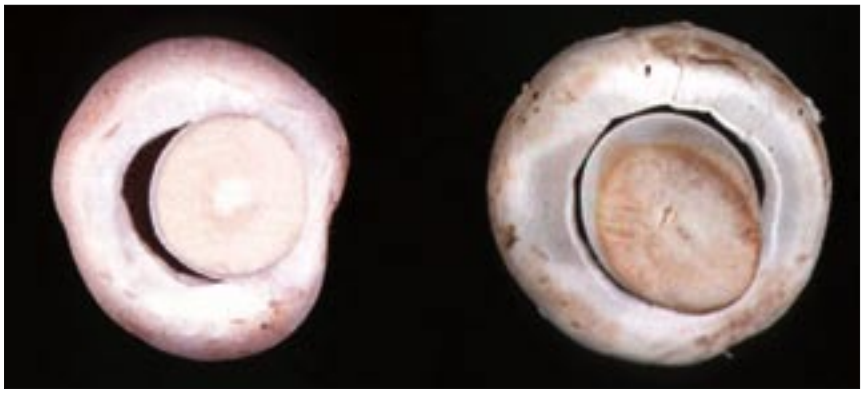
The core symptom is disruption to pinning causing a delay in sporophore production (Figure 2). This delay may affect the whole crop and may range from the imperceptible to a delay of 4 or 5 days or more.

The disruption may be localised with discrete areas of production exhibiting slight delay to complete suppression, the latter resulting in bare areas on the bed (Figure 3). On shelves, affected areas sometimes show a regular pattern along the length of a shelf.

The quality of the mushrooms produced can appear normal but the delay in production often results in major yield reduction due to the strict time constraints imposed by cropping schedules. Other symptoms that can occur are premature opening (Figure 4), mushroom distortion (Figure 5), poor keeping quality, off white mushrooms and general yield reduction over and above that caused by bare patches.

2 Pinning suppression

3 Bare patches resulting in reduced yield

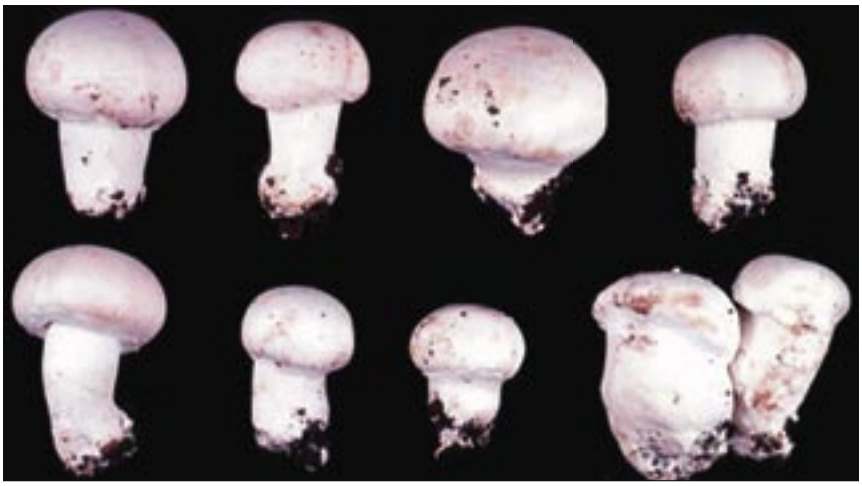


4 Premature cap opening

MVX-BS – brown symptom

An apparently related but distinct symptom of MVX is the appearance of discoloured mushrooms in a white crop (Figures 6 and 7).

- The discoloration ranges from cream through coffee to brown.
- It can occur sometimes only in one flush.
- It can affect from only a few isolated mushrooms right up to the majority of a flush.
- The symptom can appear before harvest or may not manifest itself until after the mushrooms have been picked and cold-stored.
- Affected mushrooms appear otherwise healthy and there is often no apparent yield loss or pinning disruption.
- Virus testing has shown that non-symptomatic white mushrooms can still contain the MVX-BS virus.
- Experiments have shown that the expression of the brown mushroom symptom is very variable and poorly understood. Symptom expression in infected crops was most consistent when infection levels were low and/or when infection occurred at casing time.



5 Distorted mushrooms

6 Brown mushroom symptom – isolated occurrence of coffee coloured mushrooms

7 Brown mushroom symptom – severe colouration and distribution

Diagnosis

To confirm the presence of the virus suspect mushrooms should be sent to a diagnostic laboratory (see the Further information section for addresses). MVX viral material is not visible under an electron microscope. It can be detected only by molecular techniques (genetic fingerprinting) which detect the presence of viral genetic material (dsRNAs or double stranded ribo nucleic acids), a difficult and specialist process. MVX-PD is associated with a complex pattern of dsRNA bands, many of which seem to be benign but key bands 3 and 15 have been regularly associated with the worst cases of MVX-PD. MVX-BS is consistently associated with a group of key dsRNAs; bands 18, 19, 22 and 23, although again many other apparently benign dsRNAs are usually present.

Whilst diagnosis of full blown disease can be made with confidence, other situations are more interpretative. The presence of several benign dsRNAs in mushrooms may indicate that mushroom crops are accumulating viral material and suggests that viral hygiene measures should be improved.

Prevention and control

The emphasis must be on prevention rather than control. Once the disease has become established the amount of potential inoculum on a site (eg mushroom spores and crop debris) will become vast and the impact on crop productivity may be financially unsustainable. The fact that so little infected material is needed to infect a healthy crop means that investment in improving and upgrading MVX prevention is essential, despite the perhaps considerable cost.

The general strategy for successful prevention and control is based simply on good hygiene. Firstly, reduce the potential sources of infection, which are mushroom spores and mycelial fragments from bulk phase III and uncooked out crops. Secondly, exclude these from the vulnerable processes such as spawning, spawn-running and casing. The key action points are listed in the following section. Ideally every site should develop its own specific strategy based on its own particular vulnerable areas.

Regular monitoring of the viral status of a site will give a good indication of the success of the control strategy.

Key action points for MVX prevention and control

Phase II and III operations

- Ensure complete separation of Phase II spawning halls from Phase III emptying areas.
- Ensure that spawning and Phase III emptying are not carried out at the same time.
- Do not share machinery for handling Phase II and Phase III compost.
- Ensure that Phase III tunnels, shelves or trays in which spawn-running is carried out are steamed before re-use.

Filtration and air pressure

- Ensure that the filtration of Phase II and Phase III facilities is maintained at the highest possible standard, avoiding the ingress of unfiltered air, by installing the highest possible grade of HEPA filters and by regular maintenance of filters and ducts.
- Maintain spawning halls at positive pressure with filtered air.
- Maintain Phase III emptying halls at neutral pressure.
- Consider filtering cropping room exhausts if growing open mushrooms.

Filling and casing

- Store casing under protection.
- Thoroughly clean filling and casing equipment immediately before each use to avoid recontamination.
- Carry out filling and casing in dust free conditions.

Cook out

- Cook out all crops *in situ* at termination (65–70°C for 12 hours).

Monitoring crops

- Monitor viral levels at regular intervals by sending samples for diagnosis.

Further information

Send ten mushrooms or at least 150 grams to arrive the next day. The mushrooms should be free of casing, with cut stalks still attached. Wrap individual mushrooms in coarse tissue (eg dispenser hand towel) and place the complete sample in a polythene bag. An overwrapped pre-pack is ideal. Contact Mr Nixon before sending a sample and include a letter giving details of the sample and your contact details.

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Thomas Nixon – Room 04 GA 04
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November 2007

Design and production: HDR Visual Communication