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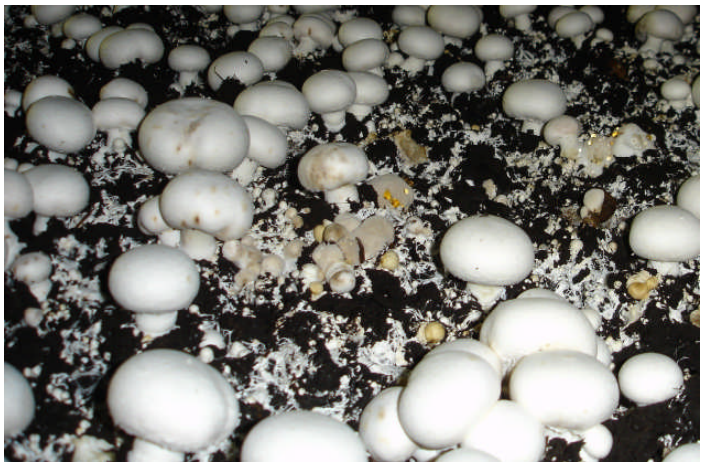
Detecting dry bubble disease on mushroom farms



Key external stakeholders:

Mushroom growers, Teagasc commercial clients (Commercial Mushroom Producers, PO), mushroom industry

Practical implications for stakeholders:

The dry bubble pathogen, *Lecanicillium fungicola,* can cause crop losses of from 5-20% so any reservoirs of the pathogen on a farm pose a serious threat to the profitability of the grower.

The main outcome of this research is that the pathogen can be found at many locations on mushroom farms, especially concrete areas and surfaces both inside, and outside of the growing rooms.

The main recommendation generated from this project is that in order to minimise the risk of spreading the disease, all surfaces and concrete areas should be disinfected daily, especially outside growing rooms, where picking staff and other farm staff intermingle.

Main results:

- A modified *L. fungicola* selective medium has been developed which allows for easier detection of the dry bubble pathogen in organic-rich mushroom farm samples
- *L. fungicola* has been detected at most locations on farms but levels were much higher inside and outside growing rooms where 2nd and 3rd flush mushrooms were being harvested
- *L. fungicola* was detected most frequently on mushroom-picking trolleys, picking equipment, growing room floors, door handles, packing crates stored close to growing rooms and canteen areas

Opportunity / Benefit:

Mushroom farms can have their growing facilities tested for the presence of the dry bubble pathogen. Teagasc advisors can inform clients of best practice to control the spread of this disease.

Collaborating Institutions:

NUI, Maynooth; PRI, Netherlands, CMP, Monaghan.

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External collaborators: Dr Kevin Kavanagh, NUI, Maynooth.
Dr. Carolien Zijlstra, Plant Research International b.v., Wageningen, The Netherlands.
Grower members of Commercial Mushroom Producers (CMP), Monaghan

1. Project background:

Dry bubble disease is caused by the pathogen *Lecanicillium fungicola* and it is the most widespread disease of commercial mushroom production world wide. If the disease gets out of control it can cause crop losses as high as 20% or more, but 1-5% losses are common. A poor understanding of how the disease spreads within and between mushroom crops has been a contributing factor in the persistence of dry bubble problems. There is currently only one approved fungicide – prochloraz - for the control of dry bubble disease and the pathogen population has developed a degree of tolerance to this active ingredient. With fewer chemicals available or approved for use, growers must adopt integrated disease control strategies if they are to achieve successful disease control. This requires them to have a greater knowledge and understanding of disease epidemiology and the importance of constantly monitoring for disease presence. Disease outbreaks are often traced back to poor farm hygiene.

2. Questions addressed by the project:

- Can a real time PCR-based detection method accurately detect the dry bubble pathogen, *Lecanicillium fungicola,* in mushroom farm samples that may contain a high level of organic matter?
- Can an existing *L. fungicola* selective medium be improved in order to increase the successful and rapid isolation of viable propagules from mushroom farm samples?
- Can these two diagnostic methods identify locations on mushroom farms where reservoirs of infective *L. fungicola* propagules occur and how do the detection methods compare?
- What are the principal locations on mushroom farms where *L. fungicola* propagules occur?

3. The experimental studies:

A number of experimental studies was conducted. Two methods to detect *L. fungicola* in mushroom farm samples were compared. DNA extraction methods and reaction conditions for real time PCR were evaluated and for use with organic-rich mushroom substrates. A range of antifungal, antibiotic and nutrient compounds in an agar base medium were evaluated for their ability to suppress the growth of non-desirable moulds and bacteria while allowing the selective growth of *L. fungicola*. Both detection methods were optimised and then used to test a variety of mushroom farm samples obtained during a series of mushroom farm visits in 2008-10. The results from the two methods were compared and analysed statistically. Each sample was categorized according to the location on the farm as well the stage of crop development in order to identify reservoirs of infection on farms where hygiene measures should be targeted.

4. Main results:

- A modified *L. fungicola* selective medium was developed which allowed for easier detection of the pathogen in organic-rich samples
- The real time PCR method, as developed, detected *L. fungicola* in three times more samples compared to the selective medium and it may be picking up non-viable pathogen propagules in the samples
- Live *L. fungicola* was detected at almost all farm locations but was most abundant inside and outside growing rooms when the 2nd & 3rd flush of mushrooms were being harvested.
- *L. fungicola* was detected most frequently on mushroom-picking trolleys, picking equipment, growing room floors, door handles, packing crates stored close to growing rooms and canteen areas
- To minimise the risk and spread of dry bubble disease the utmost attention should be given to daily disinfection of all surfaces and concrete areas, especially those areas around growing rooms and where picking staff and farm staff intermingle.

5. Opportunity/Benefit:

Mushroom farms can have their growing facilities tested for the presence of the dry bubble pathogen, which

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will highlight areas of weakness in the farms hygiene procedures. Teagasc advisors can provide their clients with the latest research results regarding the best practice to control the spread of this disease.

6. Dissemination:

The outcomes of this research have been disseminated to mushroom growers and their key staff through a series of Disease Control Seminars in 2011 and 2012, organised by stakeholders CMP in conjunction with Teagasc (venues in Cavan, Monaghan, Westmeath and Tipperary). In addition the key results were presented to a wider audience at the 2011 All Ireland Mushroom Conference in the Hillgrove Hotel in Monaghan (21 October 2011) via a presentation, poster display and informal contact with growers during the event. The Mushroom conference is a biennial event sponsored by Bord Bia in conjunction with Teagasc and key stakeholders. Teagasc advisory staff deal with grower queries on this topic and when necessary, farm visits are made to provide one to one advice tailored for specific farms. A technical service can be provided to detect *L. fungicola* in farm samples.

Formal links with Industry;

- Work with both the national and international mushroom industry continues on this subject via FP7 Project MushTV (6270) 2012- 2014

Main publications:

Piasecka J, Grogan H., Zijlstra C, Baars J.J.P and Kavanagh K. (2009) 'Detection of *Verticillium fungicola* in samples from mushroom farms using molecular and microbiological methods' Agricultural Research Forum, 2009, p131 (http://www.agresearchforum.com/publicationsarf/2009/proceedings2009.pdf)
Piasecka J, Kavanagh K. and Grogan H. (2011) 'Detection of sources of *Lecanicillium* (*Verticillium*) *fungicola* on mushroom farms'
http://wsmbmp.org/proceedings/7th%20international%20conference/1/vol1/ICMBMP7-Oral-4-20%20Piasecka.pdf
Grogan, H. (2011) 'Research Update – Teagasc Kinsealy' Proceedings of the 2011 All Ireland Mushroom Conference and Trade Show, Hillgrove Hotel, Monaghan, Ireland

Popular publications:

TResearch, Autumn, 2012: Detecting bubble trouble in mushrooms.

7. Compiled by: Dr Helen Grogan

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