Nov 19 Pathogen of the month – November 2019

Lecanicillium fungicola var. fungicola

(Preuss) Zare & W. Gams

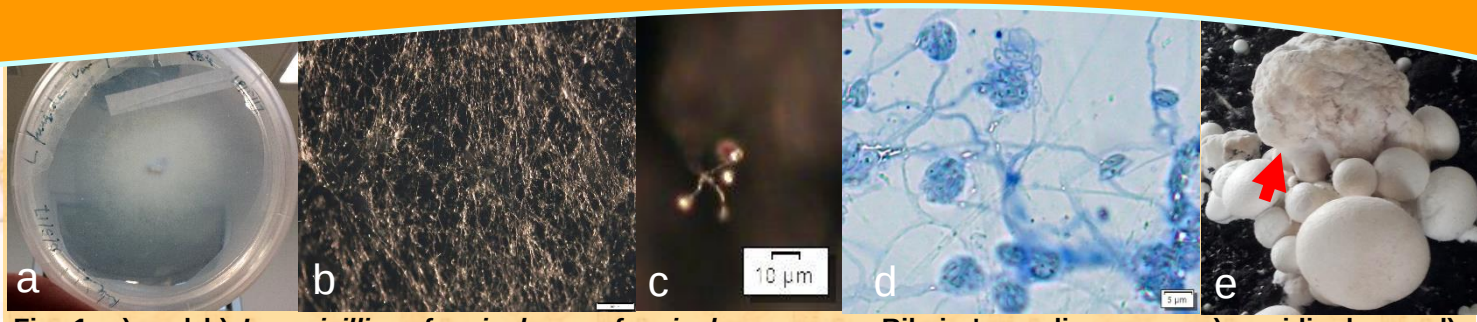

Fig. 1. a) and b) *Lecanicillium fungicola* var. *fungicola* grown on Ribeiro's medium agar; c) conidiophores d) typical spore balls (false heads) enclosed in mucilage and conidiophores stained with Evans blue (0.5g/L) and; e) anamorphous mass also known as "sclerodermoid" caused by *L. fungicola* (red arrow) surrounded by healthy developing sporophores. Image (e) kindly provided by Assoc. Prof. M. Kertesz.

Common Name: *Lecanicillium fungicola var. fungicola*
Disease: Dry bubble disease
Classification: K: Fungi P: Ascomycota C: Sordariomycetes O: Hypocreales F: Cordycipitaceae

Lecanicillium fungicola var. fungicola causes dry bubble disease in commercially cultivated white button mushroom, *Agaricus bisporus.* There are two subspecies: (a) *L. fungicola var. fungicola,* the usual variety reported in Europe and in Australia, whilst the second, *L. fungicola var. aleophilum*, is responsible for the severe outbreaks in North America. In 2019, a UK isolate of medium virulence *L. fungicola* strain 150-1 had its genome sequenced.

Biology and Ecology:

L. fungicola spores can survive for more than a year in soil, thus making soil the most common source of infection. If detected in a mushroom farm, spores can survive for 7–8 months under dry conditions. A high incidence of disease usually occurs at casing, as it appears that *L. fungicola* cannot infect *A. bisporus* vegetative mycelium in compost. Symptoms depend on the severity and initiation time of the infections. There are three types of symptoms: spotty cap i.e. small necrotic lesions on the cap or stipe, stipe blowout and bubble. The latter occurs in severe outbreaks due to mycelia of *L. fungicola* and *A. bisporus* growing together leading to the formation of misshapen sporophores which appear like a spherical mass with little or no tissue differentiation. Due to the stickiness of the spores, the spores can adhere to any carrier, such as people and insects or spread via water splash or use of contaminated equipment. Crop temperature, and relative humidity also affect the severity and onset of dry bubble disease.

Impact:

Button mushrooms comprise about 30% of the global mushroom market. *L. fungicola* is one of the four pathogens contributing to a total of 10% yield loss of white button mushroom (*Agaricus bisporus*) crops in Australia.

Distribution:

It has a worldwide distribution.

Host Range:

It infects white button mushroom and it has been isolated *from Pleurotus ostreatus* (oyster mushroom). The second subspecies can infect *Agaricus bitorquis,* another type of edible white mushroom.

Management options:

Current practices rely on the use of fungicides (after casing) and hygiene in mushroom farms, such as air filters in the ventilation systems of growing units. Routine sampling of growth rooms after each flush, farming equipment and harvesters' working apparels, such as boots and gloves, is used to monitor the presence of spores. Salting, cookouts and removal of infected mushrooms are means to control the disease. Another method is to cover infected mushrooms with sheets of damp paper for easy handling and removal. Few fungicides can be used due to: (a) becoming increasingly ineffective because of the development of fungicide resistance in the pathogen; (b) adverse effects on the fungal host. Wild strains of *A. bisporus* have a high level of tolerance to *L. fungicola* but no complete resistance has been found. Diagnostic testing kits (from AusDiagnostics) is now commercially available for growers to detect and monitor the disease and to help farmers in managing severe disease outbreaks. If dry bubble symptom occurs over a wide area, the crop may need to be terminated at the end of the flush.

Further Reading: Banks et al (2019) Microbiol Resour Announc 8 (19) e00340-19; Berendsen et al. (2010) Mol. Plant Pathol. 11 (5): 585-595; Ekman (2017) http://ahr.com.au/wp-content/uploads/2017/05/Mushroom-research-review-8.pdf; Kertesz and Thai (2018) Appl Microbiol Biotechnol (2018) 102: 1639; Marlowe and Romaine (1982) Plant Dis. 66: 859-860; McGee et al (2017) Mycologia 109 (3): 475-484; Nair and Macauley (1987) New Zealand J Agric Res 30: 107-116; Nunes et al (2017) Rev Iberoam Micol. 34(1):36–42; Pyck (2015) MushTV Factsheet 04/15. Ag Hort Dev Board. www.mushtv.eu; Rokni and Goltapeh (2019) Mycoscience 60 (2)125-131; Zare and Gams (2008) Mycological research 112: 811-824

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