

Paecilomyces Rot: *Paecilomyces niveus*

Introduction:

Paecilomyces Rot is a disease caused by the fungus *Paecilomyces niveus* (synonym *Byssochlamys nivea*, Ascomycota, Eurotiomycetes). This mold can infect apple fruits via wounds before and after harvest, and cause an interior rot. *Paecilomyces niveus* can produce patulin, a federally regulated mycotoxin that is potentially neurotoxic and carcinogenic. Spores and hyphae of *P. niveus* are the infectious agents of Paecilomyces rot.

Ascospores of *P. niveus* resist heat sterilization processes, and the fungus can also grow in extreme environments including high alcohol and low oxygen. These abilities make *P. niveus* a formidable food spoilage fungus, so diseased apples should not be used for processing into juices and sauces.

Symptoms, Signs, and Detection:

Paecilomyces rot is characterized by firm, round, slowly expanding, bruise-like lesions on the apple surface (Fig. 1). A lesion originates at the site of infection (wound) and is dark brown with or without faint concentric rings, sometimes with white hyphae protruding from lenticels. Within the apple, the rot leads to discolored but firm tissue spreading from the site of infection. Paecilomyces rot may have a faint earthy, pungent smell.

Paecilomyces niveus grows readily on common media including potato dextrose, Czapek, and malt extract agar, appearing white at first and yellowing with age. On potato dextrose agar, *P. niveus* produces abundant clusters of naked asci. Ascospores are ovoid and smooth (2.8-4.0 x 3.4-5.6 μm) (Fig. 3). Occasionally, conidia (3-6 x 2-4 μm) or thick-walled chlamydospores (6-10 μm in diameter) are produced.

Paecilomyces rot is similar to and may be misdiagnosed as a handful of other diseases:

Lesions caused by **Bull's eye rot** (*Neofabraea* spp., synonym *Cryptosporiopsis* spp.) are similar but more sunken than those caused by Paecilomyces rot. Bull's eye rot lesions may also be dotted with cream-colored acervuli. **Blue mold** (*Penicillium* spp.) produces blue-green spore masses on the fruit surface, and a soft, watery (not firm) rot of tissues.

Gray mold (*Botrytis cinerea*) typically covers fruit with gray-brown sporulation, in contrast to the very sparse white mycelium at lenticels of Paecilomyces rot. Gray mold lacks a detectable odor. **Mucor rot** (*Mucor* spp.) produces a watery tissue rot, and characteristic "pinhead" sporangia on the surface of the lesion. **Sphaeropsis rot** (*Sphaeropsis pyriputrescens*) is distinctive for its black pycnidia in decayed areas. The disease usually occurs near the stem or calyx.



Figure 1: A diseased Fuji apple 2 weeks post-inoculation via infected toothpick (in the center of the brown lesion)

Host and Distribution:

Paecilomyces rot can infect a wide variety of apple fruits. While the distribution of the Paecilomyces rot is not yet known, *P. niveus* is a ubiquitous soil fungus with a wide geographic distribution: it has been isolated from culled fruit, processed foods, and orchard and garden soils. The disease could occur wherever the fungus comes in contact with wounded apples.

Management Strategies:

Development of Paecilomyces rot may be reduced by preventing fruit contact with soil, a natural reservoir of fungal inoculum. Market and use only unwounded apples. Remove infected apples with developing characteristic lesions.

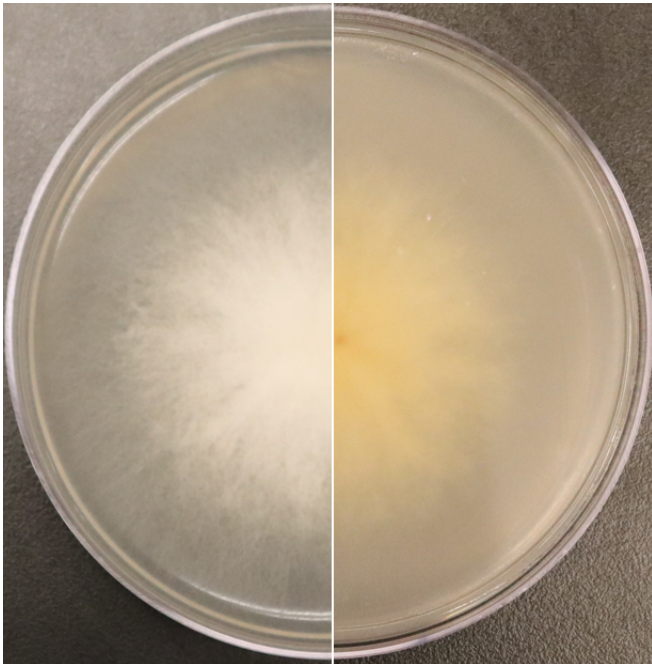


Figure 2: Four-day old colony of *Paecilomyces niveus* on potato dextrose agar, (left: front, right: reverse)

Damage:

Paecilomyces rot was first described in 2018, and its distribution and impacts are not yet understood. The disease has recently been reported in China. In the US, the disease may be infrequent, or it may have been misdiagnosed, or masked by other diseases of similar appearance.

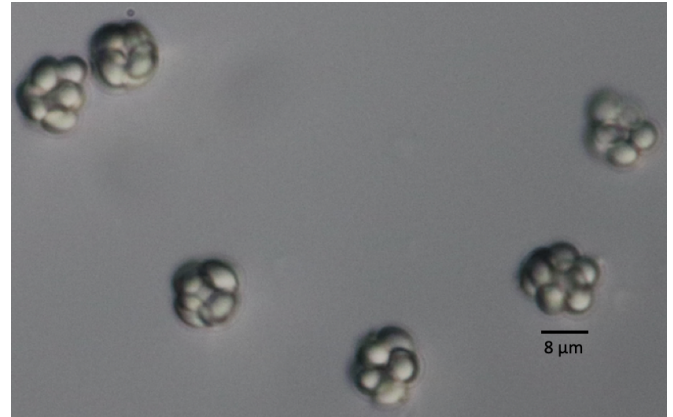


Figure 3: Spherical, eight-spored asci of *Paecilomyces niveus* may be found in the flesh of infected apples. (Picture taken under compound microscope)

Selected References:

Biango-Daniels, Megan N., and Kathie T. Hodge. "Paecilomyces rot: a new apple disease." *Plant disease* 102, no. 8 (2018): 1581-1587.

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Khokhar Ibatsam, Junhuan Wang, Irum Mukhtar, et al. "First Report of Paecilomyces Rot on Apples in China." *Plant disease* 103, no. 4 (2019).

Tournas, Valerie. "Heat-resistant fungi of importance to the food and beverage industry." *Critical Reviews in Microbiology* 20, no. 4 (1994): 243-263.

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