Diseases Caused by Fungi and Fungus-Like Organisms

First Report of Blue Mold Caused by *Penicillium polonicum* on Apple in the United States

Michael J. Bradshaw,^{1,†} Holly P. Bartholomew,¹ Franz Lichtner,² Verneta L. Gaskins,¹ and Wayne M. Jurick II¹

¹ USDA-ARS, Food Quality Laboratory, Beltsville, MD 20705

² U.S. Army Corps of Engineers Engineer Research & Development Center Cold Regions Research & Engineering Lab, Hanover, NH 03755

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Apples (*Malus domestica*, Rosaceae) are one of the most widely grown and economically valuable fruits worldwide. In Hood River County, Oregon in 1991, decayed apples exhibiting blue mold signs and symptoms were collected and spores from the causal agent of the disease were isolated. The decayed area of the infected apples was brown with soft, decayed tissue, which had bluish-green spores on the fruit surface. The whole genome of this isolate was sequenced (GenBank accession no. JYNM000000000) and it was originally identified as *Penicillium solitum* strain RS1 (Yu et al. 2016). Subsequent genome-wide species-level investigations showed higher homology to *Penicillium polonicum*. Therefore, we taxonomically and phylogenetically reevaluated the fungus in question. Colonies were analyzed growing on potato dextrose agar (PDA), Czapek yeast autolysate agar (CYA), and malt extract agar (MEA) at 25°C. Colonies on PDA were blue-green and growth was moderately deep and raised at the center with low margins. Colonies on CYA were blue-green. The range of the colony diameter after 7 days at 25°C was 24 to 27 mm on CYA and 20 to 25 mm on MEA. Colony reverse color was yellow-brown on CYA and cream on MEA. Conidiophores were terverticillate. Stipes were septate with smooth walls and measured 62 to 250 × 3 to

5 µm, $\bar{x}$ = 111.1 × 3.8 µm with 1 to 4 branches per stipe. Branches measured 8 to 25 × 2 to 6 µm, $\bar{x}$ = 4.9 × 16.3 µm with 2 to 4 metulae per branch. Metulae measured 7 to 14 × 2 to 5 µm, $\bar{x}$ = 10.1 × 3.6 µm with 1 to 3 phialides per metulae. Phialides were flask shaped and measured 5 to 11 × 2 to 5 µm, $\bar{x}$ = 7.5 × 3.4 µm. Conidia were globose to subglobose, borne in columns measuring 2.2 to 5.4 × 2.1 to 5.3 µm, $\bar{x}$ = 3.6 × 3.4 µm. Morphologically, the fungal strain RS1 matched the description of *P. polonicum* K. Zaleski from Bashir et al. (2017), Duduk et al. (2014), and Frisvad and Samson (2004) with some minor differences. The ITS, TUB, and Rpb2 sequences of the strain RS1 were extracted from GenBank accession number JYNM000000000. The sequences were then submitted for nucleotide BLAST (NCBI) analysis in GenBank and evaluated. The ITS sequence aligned 100% with the type specimen (CBS 222.28) of *P. polonicum* (GenBank accession no. NR_103687). The TUB sequence aligned over 99% with *P. polonicum* (GenBank accession nos. MK450898, MK450935, and MK450899). The Rpb2 sequences aligned 99.9% or higher with multiple *P. polonicum* specimens deposited in CBS and CMV (GenBank accession nos. MK450847, MK450846, JN985414, and JN985415). Koch's postulates were conducted. Ten apples were wounded with the point of a 16-penny nail, and 10 µl of a conidial suspension adjusted to 10⁶ conidia-distilled water/tween solution was added to the wound. Ten separate apples served as a control that were wounded and 10 µl of sterile Tween-treated water was used to simulate inoculation. None of the control apples developed signs or symptoms of the disease. The inoculated apples all developed typical blue mold symptoms. The fungus was reisolated from the fruit and deemed to be morphologically identical to those of the original *P. polonicum* RS1 isolate. To the best of our knowledge, this is the first report of blue mold caused by *P. polonicum* in the U.S.A. on apples (Farr and Rossman 2021). This information is important for the apple industry for which blue mold is a major problem.

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[†]Indicates the corresponding author.
M. J. Bradshaw; Mjb34@uw.edu