

Developing Hazelnuts (*Corylus* spp.) With Durable Resistance to Eastern Filbert Blight Caused by *Anisogramma anomala*

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Abstract

Eastern filbert blight (EFB) is a devastating fungal disease of European hazelnut, *Corylus avellana* L., and is considered to be the primary reason hazelnuts have not been developed as a commercial crop in the eastern United States. The pathogen, *Anisogramma anomala*, is native to a wide area east of the Rocky Mountains, where it is harbored by the wild hazelnut *C. americana* Marshall. While *C. americana* is tolerant of the disease, EFB causes stem cankers, dieback, and death of *C. avellana*, the hazelnut of commerce. The absence of EFB, along with a mild climate, allowed for the development of a commercial hazelnut industry in the Pacific Northwest (PNW), which thrived for nearly a century. However, despite quarantine efforts, EFB was discovered in Washington in the late 1960s and has spread throughout the Willamette Valley of Oregon, where 99 percent of the United States crop is produced, causing significant economic losses. To combat this disease, a major investment in research and breeding was made by Oregon State University (OSU), the U.S. Department of Agriculture, and the Oregon hazelnut industry. Over the last 30 years, these efforts have resulted in the development of a better understanding of *A. anomala* as well as effective disease management protocols and improved resistant cultivars, leading to a recent revival of the industry.

Building on advances made in Oregon, a hazelnut research and genetic improvement program was initiated at Rutgers University in New Jersey in 1996. Realizing the major limiting factor to production of commercial-quality hazelnuts in this region was EFB, the initial focus was to evaluate known sources of resistance to the disease in both *C. avellana* and other *Corylus* species, along with investigating pathogenic variation of the fungus, which was unknown at the time. In support of this work, close collaboration was developed with the OSU hazelnut program to evaluate their plant material when exposed to *A. anomala* isolates originating from across its native range; it is believed a limited diversity of the fungus is present in the PNW due to its occurrence likely having arisen from a single point introduction. In addition, wide germplasm collections were made in Europe to search for novel sources of resistance and to identify plants expressing other traits important in the eastern United States, such as cold hardiness and nuts that fall free from the husk at maturity. Concurrent with this work, controlled hybridizations were made annually to incorporate genes for EFB resistance from a diversity of backgrounds with the superior nut quality and yield expressed by OSU cultivars and breeding selections. Today, over 25,000 hazelnut seedlings are under evaluation in greenhouses and field nurseries at Rutgers.

An overview of the objectives and progress to date of the Rutgers breeding program were provided, including resistance screening protocols, findings on the pathogenic variation of *A. anomala*, the identification of novel sources of resistance, and the development of molecular biology tools to assess genetic diversity and population structure of the pathogen and to assist in its early detection for disease management and efficient breeding.

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