Plant Pathology Seminar Series

Ecology and Management of Stemphylium Leaf Spot of Spinach

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PhD candidate defense seminar

Abstract

Stemphylium leaf spot of spinach has re-emerged as a disease of economic concern for fresh market, processing, and seed production. The disease was first described in 2001 as being caused by *Stemphylium botryosum*, based on fungal morphology[1]. After recent revisions to the nomenclature of *Stemphylium* based on DNA sequences[2], two main species pathogenic to spinach have been identified, *S. beticola* (previously identified as *S. botryosum*) and *S. vesicarium*[3,4]. These fungi are seedborne and seed transmitted[5,6]. The objectives of this study were to elucidate the biology and epidemiology of these pathogens, and to refine options for disease management. Experiments were conducted to: i) identify *Stemphylium* species and development of the teleomorphs associated with Stemphylium leaf spot in spinach seed crops, and the species colonizing seed grown in key countries of seed production; ii) screen spinach cultivars for resistance to *S. vesicarium*; iii) determine the prevalence of resistance to the fungicides azoxystrobin and pyraclostrobin that have been used widely to control this disease; iv) evaluate genetic differences of pathogenic vs. non-pathogenic seedborne isolates of *S. vesicarium*; and v) sequence the genome of *S. beticola* isolates to complement genomes available for *S. vesicarium*. Of the 11 *Stemphylium* species identified from 244 isolates obtained from spinach seed, leaves, and residues, only isolates of *S. beticola, S. vesicarium*, and *S. drummondii* were pathogenic to spinach. The incidence of spinach seed infested by *Stemphylium* ranged from 2.5 to 73.5% per seed lot, with most isolates identified as *S. vesicarium* or *S. beticola.*

4:10 pm **| September 18, 2023** | Plant Pathology 515 2023-Fall Seminar Series | **Clark Hall 149**
Zoom Link: https://wsu.zoom.us/j/95102610389?pwd=ZXY3ckVSdlpSb2lvSXJYeGg1akpzZz09
Meeting ID: 951 0261 0389 **Passcode:** 4417 **Call in number:** 1 646 558 8656

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However, only 60.7 and 62.3% of the isolates of these two species from all spinach samples were pathogenic to spinach, respectively. Ascospores of the two species were released from spinach seed crop residues on the soil surface from mid-winter to late spring or early fall, overlapping with spinach seed crops the next season. Cultivars with resistance to *S. vesicarium* were identified for fresh market and processing spinach production[7]. In vitro and in vivo assays confirmed resistance to azoxystrobin and pyraclostrobin in all spinach leaf and seed isolates of *S. vesicarium* tested, but not in any isolates of *S. beticola*[4]. Resistant isolates all had the G143A mutation in *cytochrome b* that confers resistance. The oldest isolate in which this mutation was detected was from a spinach seed lot grown in the Netherlands in 2003. The resistance mutation also was detected in isolates from a crop in Arizona in 2013, and 82.9% of isolates from spinach seed lots harvested from crops grown after 2017 in Europe, New Zealand, and the US, demonstrating widespread fungicide resistance in spinach seed isolates of *S. vesicarium*. The number of seedborne *S. vesicarium* isolates pathogenic to spinach varied among seed lots and was negatively correlated with genetic diversity of the isolates from seed lots. Seed populations of *S. vesicarium* were structured genetically based on pathogenicity to spinach, not based on seed lot or country of seed production. Genotypes of pathogenic *S. vesicarium* isolates obtained from symptomatic leaves were also detected on the seed lots used to plant the crops, but seed populations were far more diverse genetically than foliar populations. The genomes of two *S. beticola* isolates from spinach were sequenced[8] to facilitate genetic comparison of species that cause the disease, and future development of molecular detection tools. This research provides new insights into Stemphylium leaf spot of spinach with implications for enhanced management of this disease.

References Cited:

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