

Final Report: Disease diagnostics and monitoring of recurrent and new pathogens of the ornamental industry in California, Year 1

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Project Objectives

- i) Provide laboratory-based diagnostics service of plant diseases to ornamental nursery growers,
- ii) Monitor pathogen movement and emergence of new pathogens in nursery crops in California
- iii) Disseminate ornamental crops diagnostics statistics every semester.

Significant findings

Diagnostics service. The diagnostics service to identify ornamental plant pathogens in California has been provided during eight months. In this time, we have processed a total of 24 samples. Half of the samples submitted to the clinic had foliage symptoms like leaf spots, needle blights, and the other half root rot symptoms. The pathogens *Alternaria alternata* and *Plectosphaerella cucumerica* were recovered from *Crassula capitata* and Milkweed respectively. These fungi are recurrent pathogens that cause leaf spots in other crops, but to our knowledge they have not been reported as pathogens of *Crassula capitata* and Milkweed in California. Pathogens recovered from root lesions included *Fusarium oxysporum*, *Phytophthora citricola*, *P. cinnamomi*, *P. menzei*, *Pythium ultimum*, and *Pythium* sp. from Toyon, Coffeeberry, Bay laurel, Sticky Monkey, and Poinsettia. This is the first time that *P. menzei* was recovered from an ornamental plant (Bay Laurel) in California. Additional genetic studies and pathogenicity tests are needed to confirm the species identity and pathogenicity of the isolates recovered.

Characterizing new pathogens of ornamental crops in California. Stem rot caused by *Sclerotinia minor* was diagnosed from scabiosa and foxglove in 2019. Pathogenicity studies confirmed that *S. minor* artificially infected Scabiosa ‘Merlot red’ developed stem rot, wilting, chlorosis, and plant death. *S. minor* was successfully re-isolated from symptomatic plants, confirming that this is a new pathogen of Scabiosa in California.

Results and discussion

Diagnostics service. Since June (due to COVID-19, the UC Davis campus was operating only for essential activities during the spring, and we were able to return to campus in June), the diagnostics service for ornamental plants has processed a total of 24 samples (each sample has at least 3 sub-samples, for a total of ~72 samples) from six counties and 16 different hosts (Fig.1). Half of the plants diagnosed, showed leaf spots or leaf disorder symptoms. The pathogens *Alternaria alternata* and *Plectosphaerella cucumerica* were recovered from *Crassula capitata* and Milkweed respectively. These fungi are recurrent pathogens that cause leaf spots in other crops, but to our knowledge they have not been reported as pathogens of *Crassula capitata* and Milkweed in California. Opportunity remains to evaluate the pathogenicity of the fungal isolates recovered from these hosts. Another pathogen affecting foliage, specifically, pine needles from Marin county, was identified as *Lophodermium pinastri*. This fungus has previously been reported in California causing needle cast.

The rest of the samples (3) with foliage symptoms were diagnosed as caused by abiotic factors (Fig.2). Root rot was the second most prevalent symptom (40%), where the pathogens *Fusarium oxysporum*, *Phytophthora citricola*, *P. cinnamomi*, *P. menzei*, *Pythium ultimum*, and *Pythium* sp. were recovered from Toyon, Coffeeberry, Bay laurel, Sticky Monkey, and Poinsettia respectively.

Interestingly, *P. menzei* was recovered from Bay laurel, this pathogen is closely related to *P. capsici*, and has been reported previously in California as a root rot pathogen of avocado. In order to determine if *P.*

mangei is a new pathogen of Bay laurel, genetic studies with more molecular markers to accurately identify the isolates recovered are needed, followed by pathogenicity tests.

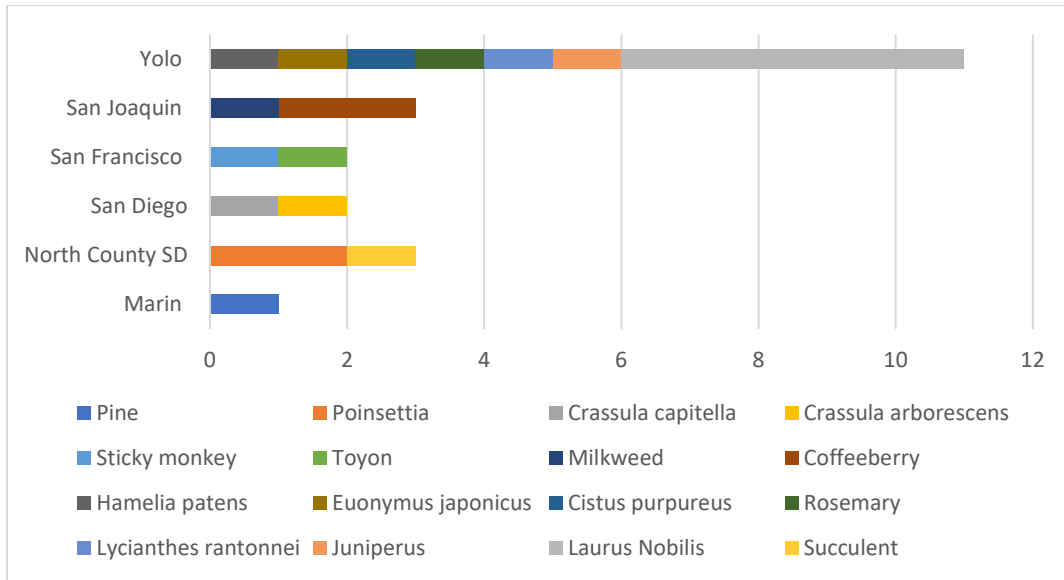


Figure 1. Ornamental samples received for diagnostics from six California Counties

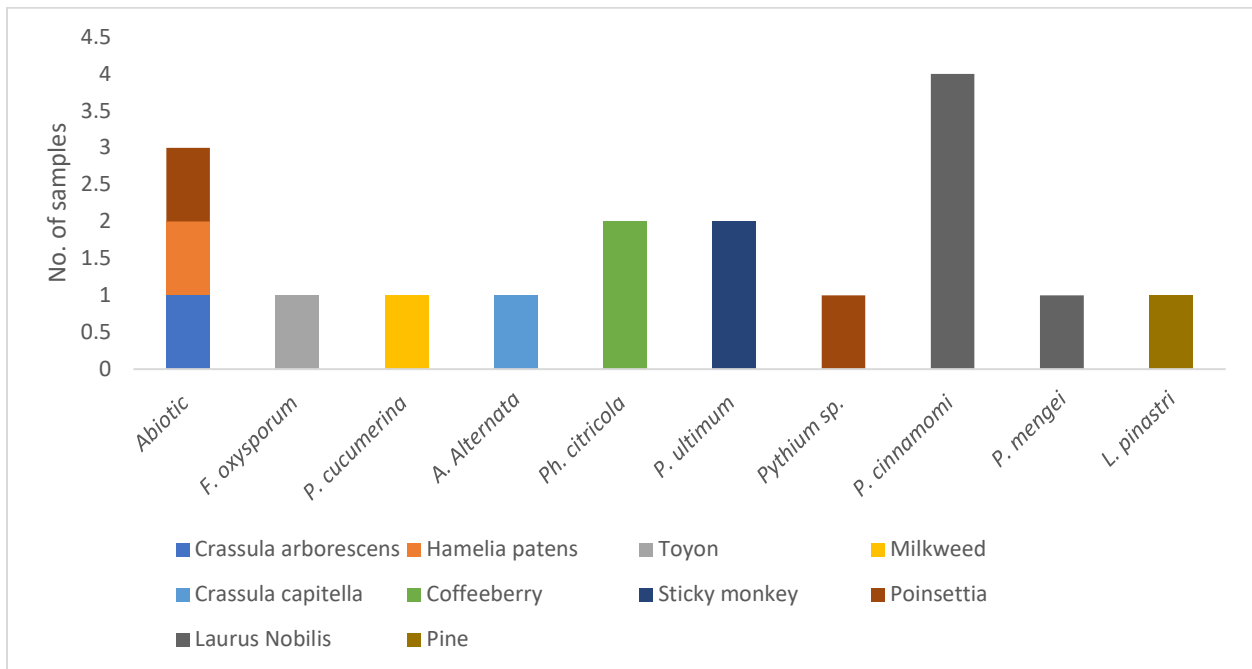


Figure 2. Pathogens recovered from 10 different hosts submitted at the ornamental diagnostics clinic.

Culture collection. With some of the fungal and oomycete isolates recovered, we have initiated the culture collection from ornamental pathogens infecting floriculture crops. This culture collection will serve as biological resources for baseline studies and future research of pathogens infecting ornamental plants. To date, we have stored 31 purified and single cell fungal and oomycetes cultures recovered from plants, and 16 oomycetes recovered from irrigation water at a nursery facility.

Characterizing new pathogens of ornamental crops in California. In 2019, Stem rot caused by *Sclerotinia minor* was diagnosed from foxglove and scabiosa. This recurrent soilborne pathogen present in California, has not been reported as pathogen of these hosts. We conducted a pathogenicity test in the greenhouse to confirm if the isolates recovered were able to cause disease in these hosts. Pathogenicity trials showed that *S. minor* caused stem rot, wilting and plant death in Scabiosa ‘Merlot Red’(Fig. 3). Symptoms appear withing 7 days of inoculation, and disease severity (1=Healthy plant; 2= minor leaf chlorosis and stem discoloration; 3=wilting and stem rot of 50% of the plant; 4= wilting and chlorosis of 75% of the plant; 5= plant death) progressed over time until causing plant death at 35 days post inoculation (Fig. 5). Non-inoculated plants did not show any disease symptom. Symptomatic plants were processed for pathogen re-isolation, and *S. minor* was recovered from all (5 out of 5) infected plants. The pathogen was not recovered from any of the non-inoculated plants. These results confirm that *S. minor* is a new pathogen of Scabiosa in California.

Foxglove inoculated plants, only showed minor leaf yellowing and did not developed severe disease symptoms. Currently we are evaluating symptom severity with another inoculation method. Experiment replicates of both crops are underway.

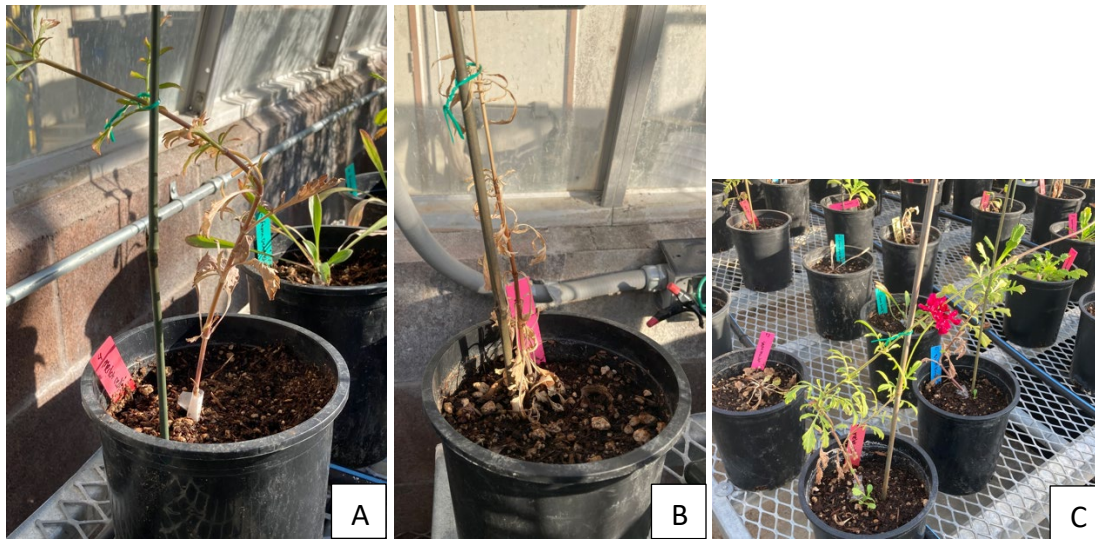


Figure 3. ‘Merlot Red’ infected with *Sclerotinia minor*. Symptoms observed in inoculated plants **A)** 7 days after inoculation, and **B)** 28 days after inoculation. **C)** Non-inoculated plants

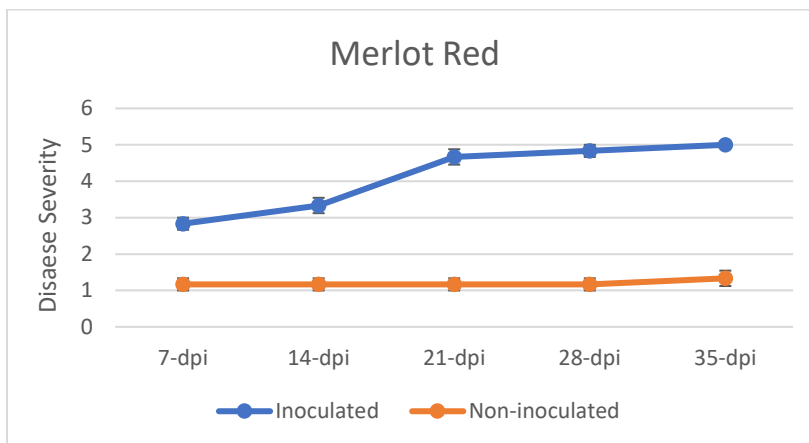


Figure 4. Disease severity over time, for Scabiosa ‘Merlot Red’ infected with *S. minor*. Disease scale was based on: 1=Healthy plant; 2= minor leaf chlorosis and stem discoloration; 3=wilting and stem rot of 50% of the plant; 4= wilting and chlorosis of 75% of the plant; 5= plant death

Disseminating findings. Preliminary reports of the samples received by the diagnostics clinic and *Sclerotinia minor* pathogenicity trials were presented at the Plant California Alliance (PCA) Research Committee Meeting in September 2020, and as a research report at the PCA grant projects committee in November 2020. Once we have completed the first year (June 2021) of receiving diagnostics samples, a summary outreach article will be available in the website <https://greenhousepathology.faculty.ucdavis.edu/>

Executive summary

- 24 samples have been submitted and diagnosed in the Greenhouse and Nursery Pathology lab at UC Davis. COVID-19 affected the number of samples received as farm advisors were unable to visit nurseries. Nevertheless, we started receiving samples directly from growers. This year we hope to get more samples through Gerry Spinelly, the new Production Horticulture Advisor for Nurseries, Floriculture and Controlled Environment Agriculture. Gerry has helped at promoting the service, and we have seen an increased in samples since his arrival to the position.
- The pathogens *Alternaria alternata* and *Plectosphaerella cucumerica* causing leaf stop in *Crassula capitata* and Milkweed have not been reported as pathogens of these hosts in California.
- *Phytophthora menzei*, a pathogen closely related to *P. capsici* was recovered from Bay laurel. This pathogen has only been reported in avocado in California. Further genetic studies to determine the species identity of the isolates recovered, and pathogenicity in bay laurel plants are needed to determine if this is a new *Phytophthora* species causing root rot in ornamentals.
- *Sclerotinia minor* was confirmed as a new pathogen of Scabiosa in California. A replicate of the study is underway.