Plant Pathology Seminar Series

"Shedding light on resistance development in *Penicillium expansum* and *Botrytis cinerea* from pome fruit and potential role of low temperatures"

Dr. Emran Ali

Research Associate with Dr. Achour Amiri, WSU Wenatchee TFREC

Blue and gray mold caused by *Penicillium expansum* and *Botrytis cinerea*, respectively are the most prominent postharvest diseases of pome fruit. To control these pathogens, packers have been applying thiabendazole (TBZ) for decades and fludioxonil (FDL) or pyrimethanil (PYR) for 10 years. The widespread occurrence of TBZ resistance and the recent emergence of PYR resistance have become concerns due to reduced efficacy and limited disease management options. In first part of my talk, I will focus on a new demethylation inhibitor fungicide-difenoconazole (DFC), which was registered in 2016 as a premixture with FDL. We evaluated sensitivity of baseline *P. expansum* isolates and investigated mechanisms of resistance lab mutants. The baseline isolates (EC_{50} <0.25 µg/ml) were very sensitive to DFC and were controlled by the label rate on detached fruit to the contrary of lab-mutants (EC_{50}>1.71 µg/ml). The expression of and the presence of mutations in the *PeCyp51* gene were investigated. In the second part, I will highlight out preliminary finding on potential impact of low temperatures used in stroarge rooms on the expression of genes, like ABC transporters, linked to fungicide resistance. Our early results show a causal relationship between overexpression of atrB in FDL and Pur-Resistant isolates of *B. cinerea* after 6 months of storage at 1^0C. Although these may indicate a higher risk for multi-drug resistance to certain fungicides to occur in storage rooms, it also helps better understand the process and how to curb it.

"Using Beneficial Fungi to Improve Honey Bee Colony Health"

Dr. Jennifer Han

Research Associate with Dr. Lori Carris, WSU Plant Pathology Pullman

Honey bees are under threat from parasitic mites and viruses, but entomopathogenic fungi and antiviral fungal mycelium extracts may provide solutions. *Varroa destructor* is an ectoparasitic mite of the honey bee that is rapidly developing resistance to chemical controls. Field trials demonstrated that *Metarhizium brunneum*, a common soil-borne entomopathogenic fungus, could infect and kill *Varroa*. Peak Varroa mortality occurred 5-7 days post treatment, with a decline in mortality starting at day 9. It was determined that a loss of conidia viability was due in part to warm hive temperatures (35 °C). Spores collected from the field trial were used in subsequent accelerated evolution experiments to develop a thermotolerant strain of *M. brunneum*. The resulting strain was selected for increased virulence against varroa over the course of four treatments. Peak varroa mortality occurred 3-9 days post treatment and *Varroa* cadavers infected with *M. brunneum* were collected 45 days after the last treatment. Spores collected from the last treatment grow significantly longer germination tubes at elevated temperatures *in vitro* compared to the parent strain.

Polypore fungi produce chemicals with activity against human and animal viruses, and bees have been observed foraging on wood decay fungi. Mycelium extracts from several Polyporales species were assessed for antiviral activity against two honey bee viruses, Deformed Wing Virus (DWV) and Lake Sinai Virus (LSV). Scaling up from cage experiments to full-sized colony trials, it was determined that feeding bees mycelial extract in sucrose syrup reduced viral levels. A 1% *Fomes fomentarius* mycelium extract reduced DWV over 800-fold in caged honey bees compared to control bees. *Ganoderma resinaceum var. resinaceum* was the best performer in the nucleus trials, reducing LSV over 45,000-fold compared to controls. The full-sized trials showed mycelium grown on *Betula sp.* exhibited greater antiviral activity than those grown on *Alnus sp.* substrate. This is the first work to demonstrate a material with anti-viral properties in honey bees.

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