

Host-Parasite Interactions between Avocado Rootstocks and *Phytophthora cinnamomi*

Continuing Project; Year 2 of 3

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Benefit to the Industry

This project will provide information on the heritability of resistance of avocado rootstocks against PRR. This information will indicate how strong is the resistance. If the resistance is strongly inherited, then a smaller number of seedlings are needed for selection of resistant cultivars. If the heritability is low, then a large number of seedlings are needed for the selection. The study can also estimate the mechanism of resistance in avocado rootstocks that will suggest different approaches for future rootstock breeding and selection.

The study of the diversity of PRR isolates in California will show us how different or similar the PRR isolates are. If the PRR isolates are very similar, then few isolates that represent all PRR groups can be used in future rootstocks screening to ensure the representation of all possible PRR isolates. If the PRR isolates are very diverse, then more isolates should be used for future rootstocks screening experiments. In combination with the study of the pathogenicity of PRR isolates on individual rootstock, if the diversity and pathogenicity are highly correlated, then diversity might be used as indexes for pathogenicity. In the future, PRR isolates can be characterized into different diversity based on quick AFLP analysis and their pathogenicity on different rootstocks can be inferred. PRR isolates from the future isolation can be easily compared with current PRR isolate collection. If the new isolates have similar AFLP profiles, it is most likely that their pathogenicity on different rootstocks will be similar to known isolates. If any new PRR isolates have different AFLP profiles, then it is necessary to test their pathogenicity on a set of rootstocks to ensure that potentially they will not overcome all available resistance. All the information will greatly influence the rootstocks breeding program. Do we need to breed resistant rootstocks against very similar PRR isolates or very diverse PRR isolates? If the PRR isolates are very different in their AFLP profiles and pathogenicity, it might suggest that the PRR populations could change quickly. If PRR populations can change quickly, should we develop a single highly resistant rootstock for the whole industry or should we develop different rootstocks with different resistance genes? Multiple resistant rootstocks with different resistance genes will impose less selection pressure on the PRR populations that in term can ensure the durability of the rootstocks.

The study of resistance of individual rootstock against different PRR isolates would show us how many different resistance genes we are dealing with. Are the resistance genes in one rootstock the same as those in another rootstock? If they are different, then appropriate crosses should be made between the two resistant rootstocks to breed rootstocks with higher resistance. This study will indicate which crosses should be made. We will also have the proper set of PRR isolates (based on parental rootstocks inoculation information) to test progeny for their resistance.

Objectives

The overall objective of this research is to study the interaction between avocado rootstocks and Phytophthora root rot isolates in California. There are three specific objectives for this part of the study. An additional objective studying the Phytophthora collar rot isolates in California was added last year.

- Study the inheritance of the control of resistance in avocado rootstocks against PRR in collaboration with the avocado rootstock breeding program of Dr. John Menge.
- Study the diversity of PRR isolates from California using Amplified Fragment Length Polymorphism (AFLP) markers and to separate the PRR isolates into different diversity groups.
- Inoculate PRR isolates from different diversity groups on individual rootstock and to determine the pathogenicity of individual PRR isolate and the resistance of individual rootstock.
- Study the diversity of Phytophthora collar rot isolates in California using the AFLP markers.

Summary

Objective 1: Study the inheritance of the control of resistance in avocado rootstocks against PRR in collaboration with the avocado rootstock breeding program of Dr. John Menge.

The data of the inheritance was analyzed and reported in last year's avocado research symposium.

Objective 2: Study the diversity of PRR isolates from California using Amplified Fragment Length Polymorphism (AFLP) markers and separate the PRR isolates into different diversity groups.

As of 8/31/2001, the DNA of 35 isolates of *P. cinnamomi* and *P. citricola* has been isolated. DNA of samples of additional 11 isolates of *P. citricola* was added since May 2001. Dr. Menge is continuing the survey of Phytophthora root rot of avocado and more samples will be used for this study. The AFLP analyses of *P. cinnamomi* were accomplished for almost all the *P. cinnamomi* isolates within the UCR *Phytophthora* collections. Additional field isolates of *P. cinnamomi* from different avocado growing area in California generated by Dr. J. Menge survey will continue be tested with the AFLP markers till the end of the project. We have screened 40 combinations of primer sets for the AFLP markers on two isolates of *P. cinnamomi*. Not all the primer set combination worked on all these two isolates. Some primer set combinations worked on one isolate, but they do not work well on other one. A total of 14 primer set combinations had been identified to work on both the *P. cinnamomi* isolates. Four out of those 14 primer set combinations worked on all *P. cinnamomi* isolates tested. We are applying these 4 primer sets on all our *P. cinnamomi* isolates. The preliminary screening of 11 isolates of *P. citricola* with AFLP markers showed that there is very limited polymorphism among the isolates (Figure 1). Isolate M319 is the only one shows different AFLP profile than other isolates. All 10 other isolates have the similar AFLP profiles based on screening with 10 primer sets (M-A/E-GT, M-A/E-TA, M-A/E-GA, M-A/E-CA, M-T/E-TA, M-T/E-CA, M-G/E-CA, M-G/E-CC, M-G/E-CG, M-G/E-TG) so far. The preliminary data suggests that there is less polymorphism within the *P. citricola* isolates of avocado when comparing with the polymorphism within *P. cinnamomi* isolates. The *P. cinnamomi* isolates of avocado in California may be more diverse than the *P. citricola* isolates of avocado. We need to test more isolates of *P. citricola* to confirm this finding.

Objective 3: Inoculate PRR isolates from different diversity groups on individual rootstock, and determines the pathogenicity of individual PRR isolate and the resistance of individual rootstock. Based on the study of polymorphism of *P. cinnamomi* isolates of avocado, we have selected seven isolates for inoculation, they are: M281, M254, M262, M280, M283, M295, and M218. We will determine the pathogenicity of individual isolates on all three rootstocks and the level of resistance/susceptibility of three rootstocks against all seven isolates.

Figure 1. AFLP profiles of 11 isolates of *P. citricola* of avocado using four primer sets. Eleven isolates of *P. citricola* from left to right are M214, M215, M216, M219, M220, M265, M266, M285, M317, M318, and M319.

