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ALMOND LEAF SCORCH

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1. Objectives

The project objectives briefly restated are as follows: Determine host range of the causal bacterium among cultivated and wild hosts, determine their role in the spread of the disease, and develop practical control measures. We also are attempting to assess the economic potential of the disease in the main almond-growing districts.

2. Interpretive Summary

We have found as reported earlier that some broadleaf and grass species in the vicinity of orchards in a Contra Costa County hot spot are infected with the leaf scorch bacterium. Also 25% of the sharpshooter insects captured from salt grass, one of the hosts, transmitted the disease to indicator grape plants in the greenhouse. Areas similar to one study area near Martinez also have susceptible species of plants in the vicinity of orchards that presumably are sources of infection. An economic host plant is sweet cherry but we were not able to detect infection in cherry trees in the Stockton area in limited tests. Cherry trees inoculated with the bacterium developed dieback symptoms similar to those of bacterial canker.

We have not been able to satisfactorily explain why certain areas are "hot spots" such as the Lancaster district and the Brentwood-Antioch area. There seem to be relationships to reservoir hosts but even so these same host plants occur in many places without much disease in almond. Based on previous work we know that new infections in one season in almond and grape may not persist through the dormant season. We need to determine whether this is due to climate, the particular varieties, or some other factor.

The powerful toxin produced by the almond leaf scorch bacteria is what causes the leaf burning symptoms and because the leaves on affected branches cannot produce enough food the branches die back and eventually the entire tree dies. With a resistant variety the course of the disease is much slower than with highly susceptible varieties. In areas known to have "hot spots", planting resistant varieties seems like the thing to do. We noticed differences in susceptibility among the common varieties in the field and also in our research plots. When we tested the toxin on some varieties that showed different degrees of susceptibility in the field, we found that they showed exactly the same differences to the toxin. This opens up the possible use of the toxin to test many different varieties and seedlings to find those most resistant.

3. Experimental Procedure

Our approach to finding reservoir hosts among weed species in the vicinity of diseased almond orchards was to find plants that were preferred by known insect vectors and plants that were susceptible to the bacteria. We were able to do both. We collected insects from plants on which significant numbers were found and tested the insects using the ELISA serological test which will tell us if they are carrying the pathogenic bacteria. We also collected leaves from the plants on which the insects were found and tested them in the same way. We also put some of the insects on healthy grape plants which would then show symptoms of Pierce's disease in a few months if the insects were carrying the bacteria. We grew the bacteria we isolated from affected almond on agar media in petri plates and by washing the surface of the agar with a little sterile water we obtained a mixture of the bacteria and the toxin they produce in the water. When this liquid is put through a very fine filter to hold back the bacteria we obtain the toxin by itself in the filtrate. We placed the petioles of leaves of different varieties of almond and other plants in the toxin and recorded any effects on the leaves.

4. Results

Our efforts to find alternate or reservoir host plants were successful but not always consistent. We found salt grass, umbrella sedge, and dallis grass infected with the leaf scorch bacteria near a small almond orchard in which almost all the trees were showing leaf scorch. Salt grass from near an almond orchard in the Antioch district also tested positive for bacterial infection. Sharpshooter vectors collected in the wild areas tested positive for infection in the spring but not consistently through the summer. Our evidence so far indicates that weed plants outside the orchards probably are the reservoirs for the leaf scorch bacteria which are carried into the orchards by vectors coming off the wild plants.

The reaction of a few selected varieties to the bacterial toxin showed that the most sensitive Long IXL, Nonpareil, Milow, Neplus and Davey showed moderate to severe reactions within 3-9 hours, whereas the most tolerant, Fritz, Ruby, Harvey and Carmel showed only mild effects after 60 hours exposure. Long IXL, Nonpareil, and Milow also are severely affected by the disease in the field. We think the toxin will be useful in screening almond varieties and seedlings for resistance.

5. Discussion

The results suggest that elimination of local sources of inoculum from wild plants might be helpful in control of spread into almond orchards. The toxin produced by the leaf scorch bacterium in pure culture should be a useful tool for rapid screening of varieties and seedlings in assessing their relative sensitivity and tolerance to the disease. Our plans for the coming year include a study of the factors influencing the persistence or failure to persist of the bacteria in trees artificially inoculated in different parts of almond areas of the Sacramento - San Joaquin valleys. This would provide information on the potential seriousness of the disease in the main areas. We hope to have the assistance of a graduate student this coming year and to continue our observations on the behavior of vector species in the vicinity of almond orchards.