Almond Board
Annual Report

Project No. 85-T11 - Almond Diseases - Brown rot, shot hole, scab, hull rot, and leaf rust

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Objectives:

1. Complete studies on fitness of the benomyl-resistant Monilinia laxa and develop alternative fungicide control measures.
2. Develop program for forecasting shot hole disease.
3. Identify the life cycle of rust on almonds.
4. Conduct test plots to determine the best method of controlling scab.
5. Investigate new approaches for hull rot control.

Interpretive Summary: Objective 1 on comparisons of parasitic fitness between the benomyl-R and benomyl-S Monolinia laxa was completed by Victor Canez, graduate student as a Ph.D. Dissertation. Benomyl-R isolates were found to be less parasitically fit yet these isolates effectively competed to cause severe blossom blight. Repeated benomyl sprays increased slightly the level in degrees of resistance. Alternative control measures developed were fungicides with different mechanisms of action than benomyl such as the sterol inhibitors (triforine) and the dicarboximides (Rovral). A monitoring system used to detect benzimidazole (benomyl and thiophanate M) in orchards is found in the dissertation. Objective 2, the development of a forecasting system is at the programatic stage. The goal is to obtain sufficient biological data in the laboratory (disease cycle under control conditions) to aid in field research (relate inoculum potential to severity of disease) in order to predict the efficacy of a single spray vs. multiple sprays on shot hole control. Objective 3 was fulfilled by showing that the life cycle of the almond rust is independent to that of other stone fruit rusts. The overwintering sources are infections on twigs. Objective 4 could not be conducted for lack of disease. Objective 5 on new approaches for hull rot control tested the use of melons as a trap for insect vectors of Rhizopus.

Publications:

Canez, V. M. 1986. Estimation of parasitic fitness of benomyl-resistant and benomyl-sensitive Monilinia laxa. Ph.D. Dissertation, Department of Plant Pathology, U. C. Davis.

Canez, V. M. 1986. Effects of fungicide management strategies on benomyl-resistant and benomyl-sensitive Monilinia laxa populations in almond orchards. Ph.D. Dissertation, Department of Plant Pathology, U. C. Davis.

Bolkan, H. A. , J. M. Ogawa, T. J. Michailides, and P. F. Kable. 1985. Physiological specialization in Tranzschelia discolor. Plant Disease 69:485-486.

Ogawa, J. M. , B. T. Manji, and R. M. Sonoda. 1985. Management of the brown rot disease on stone fruits and almonds in California. NYSAEP, Geneva, NY. Special Rept. No. 55. pp.8-15. IN Proc. Brown rot of stone fruit workshop, Ames, Iowa, July 11, 1983. 22 pp.

Experimental Procedures:

1. A) Studies on fitness of the benomyl-resistant Monilinia laxa. (Abstract of Ph.D. dissertation of V. M. Canez) Rate of in vitro germ tube elongation, pathogenicity on blossoms, virulence on twigs, incubation period and sporulation on blossoms, and sporodochial production and sporulation on twigs were quantified as parameters which constitute parasitic fitness of benomyl-resistant and benomyl-sensitive Monilinia laxa. Regression equation slope values and mean values were used to calculate relative parasitic fitness values of isolates tested for each parameter measured. Benomyl-resistant isolates from almond orchards showed reduced fitness in all parameters except virulence. Benomyl-resistant isolates from apricot showed reduced fitness only in germ tube elongation and sporulation of sporodochia. Results of a mathematical equation designed to quantify parasitic fitness using the relative fitness values showed benomyl-resistant isolates to be less parasitically fit than benomyl-sensitive isolates in the absence of benomyl residues. The effects of reduced fitness on the sporulation capacity and susequent disease levels of benomyl-resistant isolates are discussed in comparison with benomyl-sensitive isolates.

B) Alternative control measures

(Abstract dissertation of V. M. Canez) Fungicide application strategies designed to delay the buildup of fungicide resistant isolates were examined for their ability to control brown rot blossom blight and their effects on M. laxa populations in an almond orchard where approximately 75% of the M. laxa population was resistant to 1.0 mg/L benomyl. The use of a benomyl plus captan sprays in the orchard increased the in vitro mean radial growth of M. laxa isolates on benomyl-amended agar, though the increase was not as great as from isolates collected from areas with benomyl sprays alone. Iprodione and ipodione plus benomyl sprays in the orchard decreased the in vitro mean radial growth of the M. laxa population sampled. The decrease in the ability to grow on benomyl-amended agar after field treatment with iprodione may be due to the

greater sensitivity of benomyl-resistant isolates to iprodione than the benomyl-sensitive isolates. Captan sprays alone and the non-treated control showed no change in the in vitro growth of M. laxa isolates to grow on benomyl-amended agar.

2. Develop a program for forecasting shot hole disease.

As this program started in summer 1985, no specific data are available. The DEW CHAMBER arrived too late for any experimentation. The MICROLOGGER provided by the IPM project arrived in time to monitor two rainy periods of which only the second resulted in disease symptoms to develop on leaves. Preliminary sketch has been made to develop an ENVIRONMENTAL SIMULATOR to use in the orchard to develop shot hole disease by providing wetness periods for Stigminia infections and disease development.

3. Identify the life cycle of leaf rust on almond.

Physiological specialization in Tranzschelia discolor was shown. Thus the almond rust inoculum originates from almond infections. Twig infections with urediniospores were found in an orchard in the Hamilton City area adjacent to the Sacramento River.

4. Conduct test plots to determine the best method to control almond scab.

Disease did not develop sufficiently to provide data. Possiblities of using an ENVIRONMENTAL SIMULATOR to induce ifnection and disease are being considered.

5. Investigate new approaches for hull rot control.

Honey dew melons were used as trap crop in the almond orchard on the UC Davis campus. Diazinon was placed within melons through the single plugged hole provided for insect entry and feeding. This trap appeared to attract both nitidulids and vinegar flies for almost three weeks.

Considerations are made for placement of honeydew melons in the field just before hull split for possible reduction in the vector population or for attraction of vectors to the melon instead of the splitting hulls for the almond fruit.

6. Results. Data are provided in the dissertation or manuscripts cited.

7. Discussion. Benomyl-resistant M. laxa compete effectively as a parasite with the benomyl-sensitive isolates and are selected with multiple applications of benomyl alone or in combination with captan. Alternative chemicals such as triforine or iprodione effectively controls both the benomyl-resistant and sensitive isolates. Orchardists using benzimidazole compounds (Benlate or Topsin M) should be closely watching the efficacy of their treatments and use alternative fungicides if necessary. In the future, failures in brown rot control should be monitored for presence of benomyl-resistant M. laxa or possibly M. fructicola.

For shot hole, no forecasting system has been developed but growers could possibly in the future closely examine the orchards in the early winter to assess shot hole development on the leaves as they provide the inoculum for the following spring infections of developing leaves. Also high angle sprinklers could induce shot hole infections throughout the summer months increasing the population of the inoculum. In such orchards adequate control measures are essential with one or two sprays during bloom. Scab control could be related to proper timing of sprays to prevent the initial infections and buildup of inoculum. Hull rot control measures have not been developed except for the benefits of early harvest or a double harvest of the crop. Removal of infected fruits prevents toxins formed in the decaying fruit from killing the twigs or even branches.