UTAH PESTS fact sheet

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Streptomycin resistance of *Erwinia amylovora*, causal agent of fire blight

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What you should know

- Fire blight is an important disease of apple and pear in Utah
- Antibiotic streptomycin frequently used to control fire blight
- Resistance to streptomycin first detected in 2006

INTRODUCTION

Fire blight is caused by the bacterium *Erwinia amylovora* and occurs in apple and pear growing regions around the world. The pathogen kills blossoms, shoots, limbs of apple and pear trees and other rosaceous hosts. If left untreated fire blight can kill the entire tree. It is the most important bacterial disease problem for Utah apple and pear growers. The disease results in millions of dollars in losses worldwide. For more information on the disease read the Fire blight fact sheet (http://extension.usu.edu/files/publications/factsheet/fire-blight-08.pdf). Streptomycin was highly effective for management of fire blight in the United States until 1971 when the first streptomycin-resistant isolates were discovered in California. Since then resistant isolates have been found across the United States. In 2006, growers in Utah noticed a reduction in efficacy of streptomycin in some orchards (Evans, 2008).

Fig. 1. Apple shoot infected with fireblight

Fig. 2. Fire blight canker oozing bacteria

DEVELOPMENT OF RESISTANCE

There are two mechanisms for streptomycin resistance to develop in *E. amylovora*. First, resistance can develop with a single base pair mutation in the bacterial protein binding site for streptomycin. Binding of streptomycin to the protein prevents protein synthesis leading to the death of the bacteria (McManus et al. 2002). In 1995, Chiou and Jones found a single base pair mutation in the rpsL gene. Due to the mutation streptomycin is unable to bind to the protein and kill the bacteria. A second possibility for resistance to develop is through the acquisition of the gene pair StrA and StrB. They are both found on a plasmid (Huang and Burr, 1999). The genes can be transferred from one bacterium to another, even between species, resulting in resistance. There are many non-pathogenic bacteria on apple blossoms and some carry the genes and the transfer can take place any time.

MANAGEMENT

Since the occurrence of streptomycin resistance in Utah, growers who do not have resistance in their orchards spray streptomycin based on the fire blight forecasting system (http://climate.usurf.usu.edu/traps.php) to reduce the number of streptomycin applications to prevent further resistance development. In orchards with streptomycin resistance, the current recommendation is pruning infected shoots as soon as possible, applying copper based products during dormancy and the use of oxytetracycline to manage fire blight. If a tree shows any signs of fire blight the immediate removal of the infected branch 8-12 inches below symptomatic tissue is one good method to prevent the bacteria from further colonizing the tree and spreading to neighboring trees. Infected branches should be disposed off immediately and any tools that were used should be cleaned with disinfecting wipes (for example Lysol or Chlorox wipes).

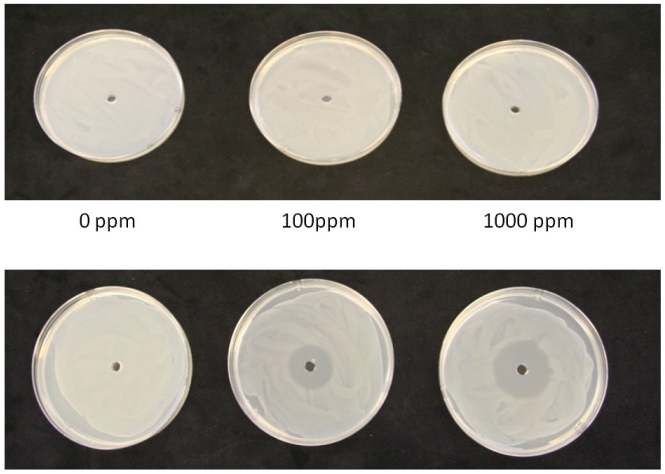

Fig. 3. Streptomycin resistance test at 0 ppm, 100 ppm (concentration used in the orchards) and 1000 ppm. The upper row shows a resistant isolate and the lower row an isolate sensitive to streptomycin

REFERENCES

Chiou, C. and Jones, A.L. (1995) Molecular analysis of high level streptomycin resistance in *Erwinia amylovora*. Phytopathology 81: 324-328.

Evans, C.K. (2008) Survey results of *Erwinia amylovora* in Utah for resistance to streptomycin and investigation comparing Kasugamycin to streptomycin and oxytetracycline for control of fire blight. Acta Horticulturae 793: 433-437

Huang, T.C. and Burr, T.J. (1999). Characterization of plasmids that encode streptomycin-resistance in bacterial epiphytes of apple. J. Appl. Microbiol. 86 : 741-751.

McManus, P. S., Stockwell, V. O., Sundin, G. W. and Jones, A. L. (2002). Antibiotic use in plant agriculture. Annu. Rev. Phytopathol. 40:443-465

Schroth, M.N., Thomson, S.V. and Moeller, W. J. (1979) Streptomycin resistance in *Erwinia amylovora*. Phytopathology 69: 565-568