St. Augustine Orchid Society
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Bacterial vs. Fungal Infections

by Sue Bottom, sbottom15@gmail.com

One of our newsletter subscribers sent in a picture of his cattleya, asking for help. It had ugly black streaks on the newest leaves and he wondered how he might save it. It looked like a very severe bacterial infection, so we recommended removing the discolored leaves, apply a copper fungicides and praying to the Orchid Gods. Mukesh took his plant to the plant pathology department at a local agricultural college near his home in India. They examined the leaf under microscope and confirmed it is a bacterial infection. They recommended removing the infected leaves and then spraying and drenching the plant with 250 ppm streptrocycline and 3gm copper oxychloride/litre water. After twice a week sprays, Mukesh sent a picture of his cattleya on the road to recovery.

Before – Cattleya with Severe Bacterial Infection
photograph courtesy of Mukesh Naik

After – Plant Sanitized and Treated
photograph courtesy of Mukesh Naik

Mukesh posted the picture on the American Orchid Society's Facebook page and got a variety of opinions as to the problem: virus, fungus and bacterial infections as well as recommendations to either toss the plant or apply a systemic fungicide/bactericide. Systemic means the active ingredient is soluble enough to be moved in the plant's vascular system. While many bactericides are effective on fungal infections, many fungicides are ineffective on bacterial infections. There is much misunderstanding when diagnosing whether a problem might be fungal or bacterial in origin, and how each type of problem should be approached. There are occasions where both types of pathogens are present.

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Orchids can be attacked by both fungi (like *Cercospora* and *Colletotrichum)* and bacteria (like P*seudomonas and Erwinia*). Bacterial soft and brown rot caused by *Erwinia* (now called *Pectobacterium*) is easy to diagnose from its foul odor and water-soaked appearance. Bacterial leaf spotting can be difficult to distinguish from a fungal infection absent a laboratory test. A bacterial infection proceeds much more quickly than a fungal infection. Bacteria are unicellular organisms that release enzymes to dissolve plant cell walls in order to feed on the nutrients inside. This causes a rapid collapse of host cell tissue, often resulting in sunken spots. Bacteria do not produce fruiting bodies, so if you see fine dotting on the leaf surfaces, you would suspect a fungal rather than bacterial infection.

Bacterial infections require different treatment than fungal infections. Per Uchida:

> *There are several important reasons for the lack of success in using chemicals to control diseases caused by bacteria or viruses. Although both fungi and bacteria are extremely small or microscopic in size, they differ tremendously from each other. Fungi are more closely related to flowering plants than they are to bacteria. Like plants, fungi have many membrane structures inside of them which allow them to process food, grow, reproduce, and survive. These membranes are destroyed by fungicides. Thus, many chemicals have been developed to destroy fungi by interfering with membrane functions. Low/moderate doses of these chemicals are relatively harmless to the plants they are designed to protect. Bacterial pathogens are formidable foes. They are more "primitive" than fungi and have few structures inside their cells. They have a small amount of genetic material, as compared to fungi or plants. The membranes in the fungi that are destroyed by chemicals are not present in bacteria. Thus, spray applications of fungicides generally have no effect on diseases caused by bacteria. Dipping plants in a fungicide bath will kill fungal pathogens, but will spread bacterial pathogens to all plants in the bath.*

The most important cultural control for foliar bacterial diseases is eliminating the presence of water on leaves. This can be difficult for plants grown exposed to rainfall or during the seasons when water condenses on leaves in the early morning. As Ann Chase wrote (2013):

> *Even if you have done everything possible with cultural controls, you may still find use of a bactericide necessary. Many bactericides have been tested over the past 30 years on a wide variety of pathogens and plants. Bacteria can rapidly develop resistance to many active ingredients (especially copper and antibiotics), and rotating between different mode-of-action groups is crucial. Even after 30 plus years, very few bactericides are available, and the majority of them contain copper. Streptomycin sulfate is also used in some parts of the United States, especially for prevention of fire blight or Erwinia soft rot.*
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> *Copper-containing products including Camelot O, Kocide, Nordox and Phyton 27 (or Phyton 35) have been consistently effective in most trials. Work at the University of Florida Mid-Florida Research and Education Center by Dr. David Norman has indicated very good control of Xanthomonas leaf spot on geranium with coppers (Kocide 3000, Camelot, Cuprofix and Phyton 27) and mancozebs (Protect DF).*

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A more recent product that has shown benefits in controlling bacterial leaf spots is Cease (originally sold as Rhapsody), which is a biological control (Bacillus subtilis). Trials with Cease shown good efficacy against Pseudomonas and Xanthomonas leaf spots on bedding plants and cut flowers. The most effective rate has been 1 percent preventively or 1.5 percent to 2 percent if symptoms are present.

In the past few years, we have also found a product called KleenGrow to be very effective for leaf spots (Pseudomonas and Xanthomonas) and soft rot (Erwinia) in many trials. This quaternary ammonium bactericide is as effective in many trials as copper.

Use cultural controls to make sure your bactericide dollars are effective. Alternating between your favorite copper product and Cease or KleenGrow has been a good way to control leaf spots caused by bacteria.

Bacterial blighting on Fredclarkeara flowers after period of extended rainfall during the fall months

Bactericides will damage the flowers, so perhaps the antibiotic Agri-Mycin might be used instead

Copper products have long been used to fight bacterial infections, but dendrobiums and many thin leaved orchids are sensitive to its toxic effects. For these, peroxides and quaternary ammonium products can be used. Bacterial flower blighting often happens during

periods of extended wet weather. Standard bactericide products can cause floral damage so perhaps using one of the antibiotics like Agri-Mycin would be helpful, similar to how it is used on tomato and pome crops.

Citations and Additional Reading

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