Fight Fire With Fire

The first step to beneficial plant protection is simply learning which fungi and bacteria are good

By Matt Kowalski

Fungi grow everywhere. They can grow on your feet; bacteria also can grow in the back of your throat. They can grow on the lawn and garden, too. Though people and plants do not share the same pathogens, both attract microbial critters that can be disfiguring, disabling and, in many cases, deadly.

Dealing with these types of plant diseases in the most natural way possible is by far the most attractive method of treatment. Today there are plenty of very good, safe and natural disease control products that greenhouse growers have to choose from.

Beneficial microbes typically form symbiotic relationships with plants, which means the microbes get something from the plant and the plant gets something equal in return from the microbe.

Prevention Is the Best Medicine

Yes, Grandma was right. Eat well, exercise, take your vitamins and get plenty of rest. For plants, that means good soil, regular (but not too much) watering and proper nutrients. This is what I like to call the first line of defense. Just like people, plants can better defend themselves from sickness if they are healthy to begin with.

Still, even with the proper regimen, disease can be blown in by air, carried through watering or vectored (a fancy word we all learned in high school biology but never thought we'd ever use in real life) by insects or animals. Even the most properly cared for plant can be overwhelmed by an onslaught of disease causing microorganisms that slime the roots, canker the stems and liquify the leaves.

"All right, Kowalski," you say. "I've done everything I'm supposed to do to keep the plant healthy. I've maintained the first line of defense. What's next?"

Bring on the Good Guys

We've all heard of probiotics, the beneficial bacteria that live in our stomach and intestines that help with "moving things along." There are, in fact, millions of microorganisms that live all over our skin, hair, nails and inside our bodies that don't really hurt or help us in anyway. They're just kind of along for the ride. Plants have

Left: Salva mums on the right show improved root systems in this Streptomyces lydicus *trial. Left plant is untreated.*

Below: Stronger roots flourish as a result of beneficial microbes like Streptomyces lydicus.

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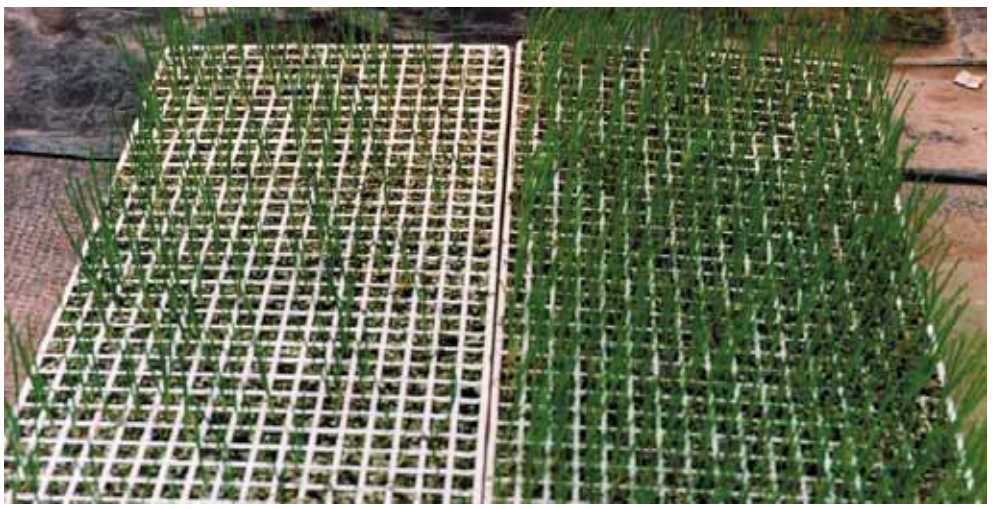
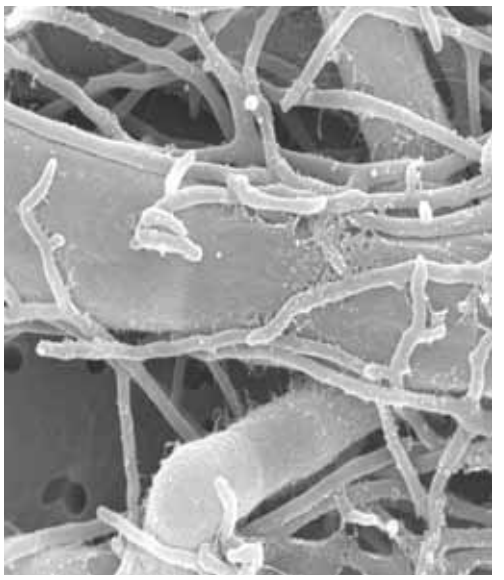
these microorganisms, too. They live on the roots, stems, foliage and other parts. As with human microorganisms, most of them don't really do anything to help the plant. There are some that are known to help with nutrient uptake. A few help with rooting. But there are some, a very small percentage, that actually live on the plant and aggressively attack invading diseases. These are known as beneficial microbes, and they typically form symbiotic relationships with plants, which means the microbes get something from the plant (in the form of food from waste material produced in the roots or leaves) and the plant gets something equal in return from the microbe (in the form of protection from disease).

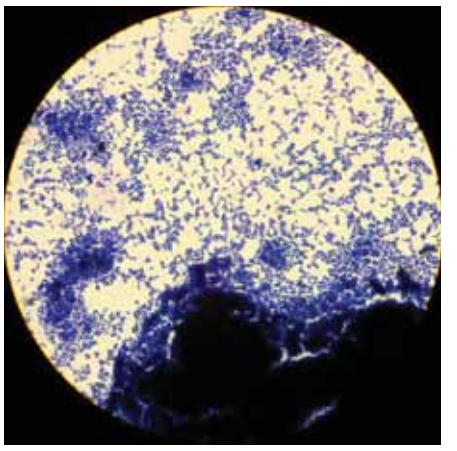
We see this relationship a lot in nature, from the teeth-cleaning fish that hang out in sharks' mouths to bees that pollinate flowering plants. The theory goes that these relationships evolved over millions. Each organism (whether plant or microbe) was able to give and receive maximum benefits from its partner. In



The onion plugs on the right show enormous promise in the Streptomyces lydicus *trial. The trial on the left is untreated.*



Streptomyces griseoviridis *attacking Alternaria. (Photo: Dianne Cupples, Agrifood Canada)*



Bascillus subtilus *under an electron microscope. (Photo: University of Cincinnati - Clermont.)*

Common plant diseases where beneficial microbes can help fight back:

Root diseases
Pythium
Phytophthora
Fusarium
Rhizoctonia

Foliar diseases
Powdery Mildew
Downy Mildew
Botrytis
Monilinia

Gerbera daisies treated with Actinovate SP

Gerbera daisies untreated and infected with powdery mildew

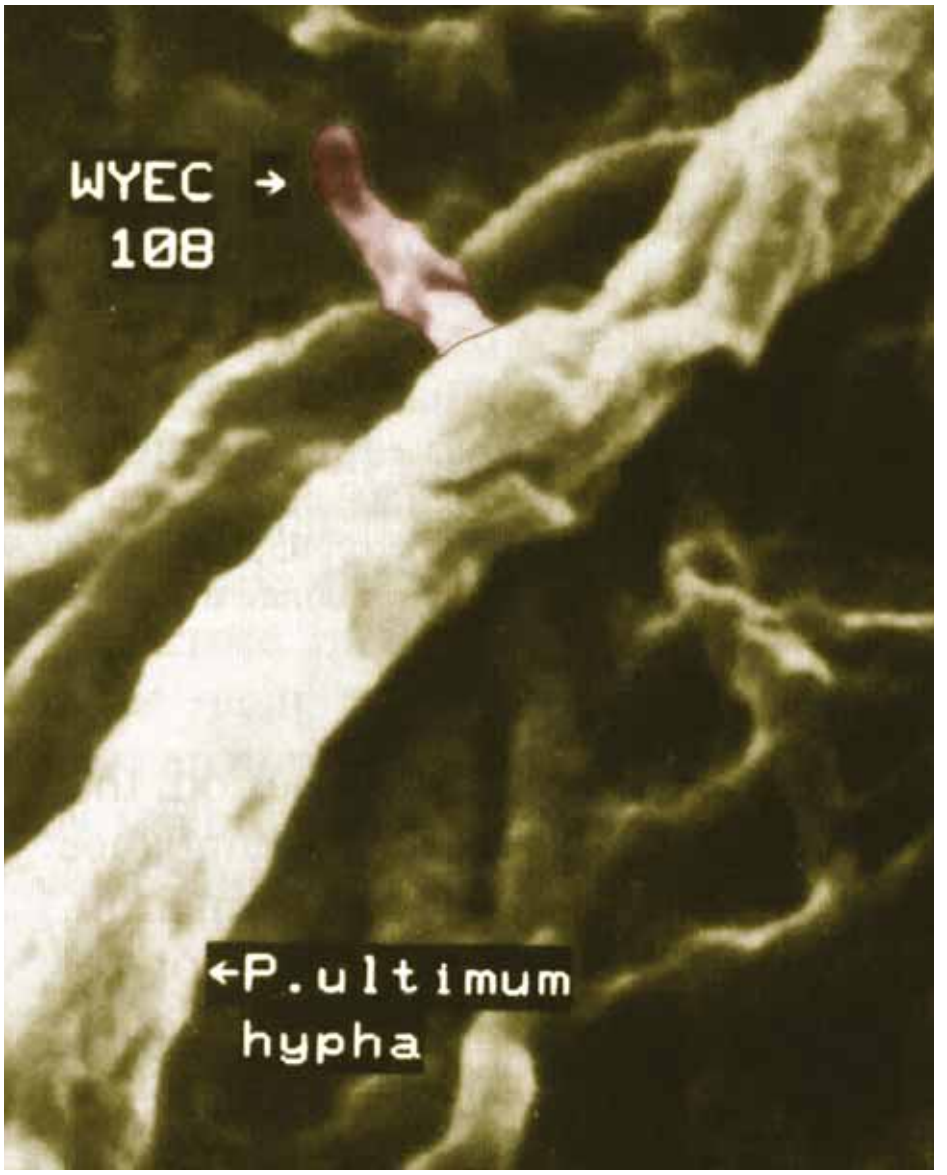
the case of beneficial microorganisms they have been able to develop several ways in dealing with the plant's enemies including producing pathogen-kiling enzymes, antibiotics and other antifungal metabolites. In fact, certain beneficial microorganisms even attach and feed on harmful diseases. Yep, not only do they "eat their lunch," they eat them for lunch too.

Good fungus. Good bacterium. And, um…good actinomycete?

There are good fungi, good bacteria and good actinomyces. First off, yes. There is such thing as a good fungus. The one most beneficial to plants is called *Trichoderma harzianum*. This particular fungus grows on roots and helps defend the root zone from bad fungi. Trichoderma survive best in the root zone and populations tend to decline in soil alone.

Bacillus are a family of good bacteria that have several beneficial genii, which act to control plant diseases. Most notably, *Bascillus subtilus* and *Bascillus pumilus* have been very heavily researched. These beneficial bacteria can grow on roots and in the soil.

The final beneficial soil microbe you need to pay attention to is the actinomycete, probably the most populous soil microbe in the world. However, most do not interact with plants much. They're just in the soil, doing their own thing. A very, very small percentage of actinomycetes live on plants roots and foliage. And a small percentage of those are actually beneficial and protective to the plant. Of these there are only two you need to worry



This magnified photo from an electron microscope shows Streptomyces lydicus *attacking Pythium strand. (Photo: Natural Industries)*

about: *Streptomyces lydicus* and *Streptomyces griseoviridis*. They both colonize the soil, roots and leaves of plants very well. They produce byproducts destructive to diseases, byproducts like the enzyme chitenase as well as many unique antibiotics. Did you know most antibiotics in human medicine are derived from antibiotics produced by streptomyces? And the antibiotic streptomycin is used by apple and pear growers around the world to fight fire blight, a deadly foliar disease. Streptomyces are also great plant-disease fighters because they are known to parasitize pathogenic fungal pathogens.

Picking the Best

Remember the cardinal rule: Find products that are EPA registered. EPA-registered microbial fungicides have not only gone through the EPA's exhaustive safety testing process and have stacks of research compiled on efficacy and plant interaction, but they are also usually one particular strain of microorganisms whose disease-fighting capabilities are well documented.

A Part of the Solution

By no means can all harmful fungi and bacteria be completely controlled by beneficial microbes. But it is a very strong beginning to protecting your greenhouse, nursery, lawn and garden. Once you have this natural system in place then you can move on to the third line of defense: plant extracts and biorationals. But that is another article for another day.

Matt Kowalski is the president of Natural Industries in Houston, Texas. More information about Natural Industries and plant protection products can be found at www.naturalindustries.com.