St. Augustine Orchid Society
www.staugorchidsociety.org

Orchid Disease Control

Part 3 – Bactericides and Fungicides

by Sue Bottom, sbottom15@hotmail.com

There are many beneficial bacterial and fungal organisms that are present in the orchid environment, many living in the rhizosphere on or around your orchid roots. The metabolic byproducts of these good microorganisms can enhance plant growth. There are also pathogenic organisms that can infect your plant, entering the plant through the stomata, the roots or open wounds and then growing inside the plant, beyond the reach of many chemicals. Before buying and using this or that chemical, it's important to understand what a particular chemical can and cannot do in your quest to protect your orchids from disease.

Choosing Fungicides for Your Growing Conditions. There are many fungicides and bactericides available from local nurseries, nursery supply or online sources like pestrong.com or domyownpestcontrol.com. Table 1 contains a listing of fungicidal products effective on the diseases affecting orchids, excluding products costing $200 or more and Table 2 lists some of the biofungicides labeled for diseases that plague orchids. If not labeled specifically for orchids, follow the instructions given for ornamentals. Read the label carefully prior to purchase to make sure the product is suitable for your intended use. Apologies to those living in jurisdictions that restrict your ability to buy certain chemicals. If you can't find a product listed by its trade name, try searching by the active ingredient. In order to choose the right fungicide for your application, you should understand a few technical terms.

Commonly Available Bactericides and Fungicides for Your Orchid Medicine Cabinet

1. Keep a spray bottle of hydrogen peroxide in your growing area to immediately respond to bacterial infections.

2. Daconil is an old style fungicide that is effective in protecting against fungal bulb, root and stem rots as well as leaf and flower blighting fungi

3. Copper based fungicides have long been used as bactericides and fungicides although they shouldn't be used on dendrobiums or other sensitive genera

Contact vs. Systemic Fungicides. Most of the commonly available fungicides are contact fungicides. They are adsorbed onto the exterior of plant surfaces and act like a protective shield preventing fungal spores from infecting your plant, so spraying all exposed surfaces is critical to control. Contact fungicides continue to work for some period of time until the fungicide residue washes away or new, unprotected plant parts grow. There are also

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systemic fungicides, which simply means that the fungicides penetrate into the plant either locally in the general area of contact (sometimes called translaminar or locally systemic), move upward through the water conducting xylem (called xylem mobile) or bidirectionally if they move through both the food conducting phloem and upward through the xylem (called amphimobile). Systemic fungicides can be distributed through the plant and protect it from infection from the inside out, so they tend to have longer residual action. Many of the specialty (and expensive) fungicides are systemic.

Specific Target Site vs. Multisite Fungicides. Some fungicides have a very specific target site which simply means they disrupt a single biochemical process within the fungus, say RNA biosynthesis or cell division. Multisite fungicides have multiple modes of action so they disrupt several different processes with a single application. Fungicides are categorized into FRAC groups (for the Fungicide Resistance Action Committee) according to their mode of action. Alternating fungicides having different modes of action helps prevent pathogens from developing resistance to a given fungicide.

Selecting Fungicides for Your Conditions. The commonly available fungicides from your local nursery are affordable and effective against some diseases, including bacterial diseases, leaf spotting and flower blighting fungi. You may consider supplementing your arsenal with one or two of the specialty (read expensive) fungicides to control the more difficult diseases caused by the water molds or bulb, room and stem fungal rots. Subdue is an often recommended chemical for the water molds and there are several products that are effective for a wide range of diseases like Heritage, Medallion or Banrot. Some fungicides/bactericides for various types of orchid diseases are given in Table 3.

Table 3 – Bactericides and Fungicides for Various Orchid Diseases

Disease	Symptoms and Response	Fungicides/Bactericides
Bacterial Diseases Brown Rot and Soft Rot caused by *Erwinia* species, now called *Pectobacterium*	Rapidly expanding water soaked spots on leaves; reduce humidity and leaf wetness, remove infected tissue with sterile tool	*Multisite Contact Fungicides:* Copper products (Kocide, CuPro, Liquid Copper, Phyton, harmful to dendrobiums) Hydrogen Peroxide products (Peroxide, ZeroTol) Quaternary ammonium products (Physan, Consan, SA-20, Pool Algaecide, Kleen Grow)
Bacterial Brown Spot caused by *Pseudomonas* species now called *Acidovorax*	Small, round, water-soaked lesions; reduce humidity and leaf wetness, remove infected tissue with sterile tool	
Water Molds Black Rot caused by *Pythium* and *Phytophthora* species	Rapidly expanding black lesions from the basal portion of pseudobulbs; reduce wetness, remove infected tissue with sterile tool	*Products from FRAC Group:* 4 (Subdue) 11 (Empress, Heritage) 14 (Terrazole, Truban Combo 7 & 11 (Pageant) Combo 1 & 14 (Banrot) 33 (Aliette)

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Disease	Symptoms and Response	Fungicides/Bactericides
Fungal Bulb, Root & Stem Rots Fusarium Wilt caused by *Fusarium* species	Leaves and pseudobulbs gray and wilt, vascular system has red band; disinfect cutting tools, remove infected tissue with sterile tool	*Multisite Contact Fungicides:* Daconil *Products from FRAC Groups:* 1 (Cleary's 3336, Thiomyl) 2 (Chipco 26019) 12 (Medallion) Combo 7 & 11 (Pageant) Combo 1 & 14 (Banrot)
Root Rot caused by *Rhizoctonia solani*	Root disease beginning on older growths with roots rotting and base of pseudobulb browning; repot promptly when mix degrades, remove infected tissue with sterile tool and repot	*Multisite Contact Fungicides:* Daconil *Products from FRAC Groups:* 1 (Cleary's 3336, Thiomyl) 2 (Chipco 26019) 11 (Empress, Heritage) 12 (Medallion) 14 (Terraclor) Combo 7 & 11 (Pageant) Combo 1 & 14 (Banrot)
Southern Blight / Collar Rot caused by *Sclerotium rolfsii*	Rapid collapse and rotting of the roots, pseudobulbs and lower parts of the leaves; most active in warm, moist weather, remove infected tissue with sterile tool.	P*roducts from FRAC Groups:* 11 (Heritage) 12 (Medallion) 14 (Terraclor) Combo 7 & 11 (Pageant)
Leaf Spotting Fungi Anthracnose caused by *Colletotrichum* and *Glomerella* species	Leaf tips turn brown beginning at the apex and proceeding toward the base; lower leaf wetness and increase light, remove infected tissue with sterile tool.	*Multisite Contact Fungicides:* Copper products (Kocide, CuPro, Liquid Copper, Phyton), copper is harmful to dendrobiums Hydrogen Peroxide products (Peroxide, ZeroTol) Quaternary ammonium products (Physan, Consan, SA-20, Pool Algaecide, Kleen Grow) Captan, Daconil, Dithane, Protect *Products from FRAC Groups:* 1 (Cleary's 3336, Thiomyl) 11 (Heritage) Combo 7 & 11 (Pageant)
Cercospora species	Small purplish spots to blotchy purplish discoloration in irregular patterns; improve air movement and reduce leaf wetness, remove severely infected tissue with sterile tool	
Phyllostictina / Guignardia species	Small sunken spots/dark diamond shaped lesions with sandpaper textured sporing structures; remove severely infected tissue with sterile tool	

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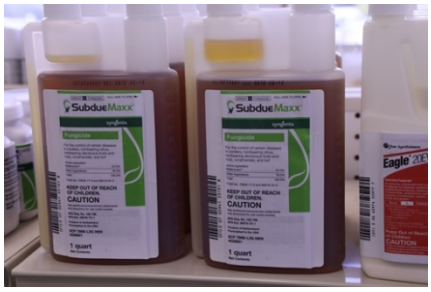
Disease	**Symptoms and Response**	**Fungicides/Bactericides**
Flower Blighting Gray Mold caused by *Botrytis cinerea*	Small spots on flowers, spots may cover the entire flower with a gray fungal growth; improve air movement, lower humidity, remove all infected flowers	*Multisite Contact Fungicides:* Captan, Daconil, Dithane, Protect *Products from FRAC Groups:* 2 (Chipco 26019) 11 (Heritage) 12 (Medallion) Combo 7 & 11 (Pageant)
Review and follow label instructions before selecting any chemical or making any application.		

Sprays vs. Drench Applications. You must determine whether the fungicide is best applied as a spray to the aerial portion of the plant or a drench to the root zone of the plant. In general, protection against bacterial diseases, leaf spotting and flower blighting diseases is best through foliar sprays while drench applications are best for the root, stem and bulb rots as well as water molds. With drenches, you pour the solution through the media so you have the potential to kill the beneficial microorganisms living in the rhizosphere in addition to the pathogenic organisms. It may be preferable to selectively use single target site fungicides when drenching rather than those with multiple modes of action. Where a hydrogen peroxide, copper or quaternary ammonium compound fungicide works well for foliar applications, you might think twice whether you want to pour them through the root zone given the unknown impact of beneficial microflora. These are denoted as drench? in Table 1.

Specialty Chemicals



4. Subdue is often recommended for protection against the water molds. It is said to be one of the few fungicides that has curative rather than just protectant powers. It is not inexpensive, but very little is required with each application.

5. Heritage is a locally systemic, broad spectrum fungicide that can be used as a spray or a drench for protection against the water molds, bulb, root and stem rots and leaf spotting fungi.

6. Pageant with its two active ingredients is one of the newer fungicides, effective for many diseases including water molds, the bulb, root and stem rots and leaf spotting fungi.

Preventative Disease Program. Always remember the fact that most fungicides help protect your plants from infection rather than cure them after they become infected. Very

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few fungicides can actually eradicate disease. For most fungicides to work, they must be applied prior to the plant becoming infected. This suggests that you should have a preventative program for disease control. If you recognize that certain diseases occur during certain times of the year, you can structure a prophylactic fungicide application program. As an example, Table 4 contains an idealized spray schedule based on my growing conditions and past experiences.

Table 4 – Example of an Idealized Preventative Fungicide Application Schedule

	Bacterial Disease	Water Molds	Fungal Bulb, Root & Stem Rots	Anthracnose & Leaf Spotting Fungi	Flower Blighting
Spring			Semiannual drench for fungal rot control		Spray weekly for botrytis if nights below 65F
Summer		Drench bimonthly during hot humid months		Spray monthly during rainy weather	
Fall	Spray phals and paphs with copper before winter		Semiannual drench for fungal rot control	Spray before moving to winter home	Spray weekly for botrytis if nights below 65F
Winter					Spray weekly for botrytis if nights below 65F
Monthly Under Bench Treatments	Spray monthly to disinfect surfaces using bleach, pool algaecide and copper (copper will also help with snails), use in combination with pesticides for cockroaches, pupating thrips, snails, etc.				
After Repotting	Spray phals and paphs with copper after repotting	Drench all plants with fungicides effective for water molds as well as fungal bulb, root and stem rots after repotting			

After Repotting. After repotting the phals and paphs, they are sprayed with a copper fungicide to help prevent bacterial infection. All plants are drenched with Banrot after repotting to help protect against the water molds. Banrot is an oldie goldie dual action

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fungicide that is on the affordable side of the specialty fungicides. Since I started drenching with Banrot after repotting, the mortality rate of repotted orchids has plummeted.

Summer Black Rot Drenches. The water molds enjoy the hot humid and often wet summer months in Florida, so it is important to not allow plants to remain wet too long and to finish repotting before July. Of course the bifoliate cattleya rooting habits sometimes require this second rule to be broken. Despite cultural precautions, a few cattleyas succumb each year to Black Rot, so I invested in the more powerful (and expensive) chemical Subdue. Starting in late spring, Subdue is applied as a drench every other month through the hot humid summer.

Semiannual Drenches for Bulb, Stem and Root Rots. There are occasional outbreaks of the fungal bulb, stem and root rots in the greenhouse, particularly Rhizoctonia. In order to protect the plants, a spring and fall drench of Terraclor has been used. Chemicals like Heritage or Pageant may be used going forward, in that these formulations are effective for Rhizoctonia as well as a broad spectrum of other pathogens.

Summer Rainy Weather. Extended rainy periods mean lots of humidity, lots of leaf wetness and not too much sun, all of which encourage the growth of leaf spotting fungi. Monthly precautionary sprays with copper (not on dendrobiums or other sensitive genera, and not on plants in bloom), quaternary ammonium compounds or Cleary's 3336/Thiomyl help protect plants during wet weather.

Botrytis During Winter. In prior years, there have been botrytis infections in the greenhouse which quickly blight the flowers. The traditional advice to avoid botrytis is to decrease humidity, increase air movement and keep temperatures above 65ºF (18ºC) or so. Given the high price of propane, the greenhouse heaters are set to come on at 53ºF (12ºC) so weekly spraying with Daconil or Medallion during the cold spells may be the answer to prevent botrytis from getting a foothold.

Under Bench Treatments. Monthly under benches help kill any pathogenic organisms that may be present in the growing environment. Bleach, quaternary ammonium compounds and copper products are in the rotation, with the secondary benefit that slugs and snails don't like copper. This is in addition to a rigorous program of removing fallen leaves or flowers which otherwise can be a breeding ground for infectious diseases.

Once you understand the diseases caused by pathogenic bacteria and fungi, you will want to have an arsenal of weapons to prevent or battle the spread of infection. Most fungicides protect plants from becoming diseased, most really can't cure disease once it is inside the plant. If you find yourself in the unfortunate position of finding evidence of pathogenic organisms in your growing area, be brutal in cutting away diseased tissue even if it means discarding an unhealthy plant. Once the plant is sanitized, you can spray or drench it with a fungicide to prevent the spread of disease. Never forget that chemicals are your last line of defense. The most important thing you can do is maximize your orchid culture because

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healthy and vigorously growing plants are more capable of resisting disease via their natural defenses. Maintain buoyant air movement in your growing area to help prevent spores from settling on the leaves. Disinfect growing areas regularly. Be scrupulous about sanitation. Rather than apply chemicals after you notice rots or fungal infections, try to anticipate periods when your plants may be subjected to increased disease pressure and think about giving them a protective coat of armor ahead of time.

Citations and Additional Reading:

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Table 1 - Fungicides and Bactericides for Various Orchid Diseases						
Trade Name and Active Ingredient	Mode, Mobility & Cost	Bacterial Disease	Water Molds	Fungal Root & Stem Rots	Anthracnose & Leaf Spotting	Flower Blighting
Commonly Available Fungicides and Bactericides						
Captan Captan 50%	Multisite Contact $15/8 oz (0.2 kg)				spray	spray
Consan, Physan Quaternary Ammonium Chlorides 20%	Unclassified Contact $23/pint (0.5 l)	spray			spray	spray
Daconil Chlorothalonil 29.6%	Multisite 5 Contac $19/pint (0.5 l)			drench?	spray	spray
Dithane, Mancozeb Mn, Zn, Ethylene bisdithiocarbamate 80%	Multisite 3 Contact $13/6 oz (0.2 kg)				spray	spray
CuPro 5000 (Kocide) Copper Hydroxide 61.3%	Multisite 1 Contact $38/3 lb (1.4 kg)	spray			spray	spray
Liquid Copper Copper Ammonium Complex 31.4%	Multisite 1 Contact $16/pint (0.5 l)	spray			spray	spray
SA-20 Disinfectant Quaternary Ammonium Chlorides 20%	Unclassified Contact $36/gal (3.8 l)	spray			spray	spray
Specialty Fungicides and Bactericides						
Aliette WDG Fosetyl aluminum 80%	Multisite 33 Amphimobile $155/5 lb (2.3 kg)		drench?			
Chipco 26019 Iprodione 50%	Single Site 1 Xylem Mobile $110/2 lb (0.9 kg)			drench		spray
Cleary's 3336F Thiophanate methyl 41.25%	Single Site 2 Xylem Mobile $57/qt (0.9 l)			drench	spray	spray
Daconil Ultrex Chlorothalonil 82.5%	Multisite 5 Contact $67/5 lb (2.3 kg)			drench?	spray	spray
Empress Pyraclostrobin 23.3%	Single Site 11 Local Systemic $175/0.75 qt (0.7 l)		drench	drench		
Heritage DF50 Azoxystrobin 50%	Single Site 11 Local Systemic $115/4 oz (0.1 kg)		drench	drench	spray	spray
KleenGrow 4th Generation Ammonium Chlorides 7.5%	Unclassified Contact $130/gal (3.8 l)	spray	drench?	drench?	spray	spray

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Table 1 - Fungicides and Bactericides for Various Orchid Diseases

Trade Name and Active Ingredient	Mode, Mobility & Cost	Bacterial Disease	Water Molds	Fungal Root & Stem Rots	Anthracnose & Leaf Spotting	Flower Blighting
Medallion Fludioxonil 50%	Single Site 12 Contact $185/8 oz (0.1 kg)			drench	spray	spray
OHP 6672 (Cleary's 3336 WP) Thiophanate methyl 50%	Single Site 2 Xylem Mobile $33/2 lb (0.9 kg)			drench	spray	spray
Phyton 35 (Phyton 27) Copper sulfate pentahydrate 21.27%	Multisite 1 Contact $90/1.1 qt (1 l)	spray	drench?	drench?	spray	spray
Protect 75 DF Mn, Zn, Ethylene bisdithiocarbamate 75%	Multisite 3 Contact $68/6 lb (2.7 kg)				spray	spray
Subdue MAXX Metalaxyl 21.3%	Single Site 4 Xylem Mobile $180/qt (0.9 l)		drench			
Terraclor 400 Pentachloronitrobenzene (PCNB) 40%	Single Site 14 Contact $110/gal (3.8 l)			drench		
Terrazole 35 WP Etridiazole 35%	Single Site 14 Contact $93/2 lb (0.9 kg)		drench			
Thiomyl Thiophanate methyl 50%	Single Site 2 Xylem Mobile $23/6 oz (0.2 l)			drench	spray	spray
Truban 23 EC Etridiazole 25%	Single Site 14 Contact $73/qt (0.9 l)		drench			
Combination Specialty Fungicides and Bactericides						
Banrot 40 WP Etridiazole 15%, Thiophanate methyl 25%	Single Sites 1 &14 Xylem Mobile $83/2 lb (0.9 kg)		drench	drench	spray	spray
Pageant Pyraclostrobin 12.8%, Boscalid 25.2%	Single Sites 7 &11 Xylem Mobile $103/1 lb		drench	drench	spray	spray
Zerotol 2.0 Peroxide 27.1%, Peroxyacetic acid 2.0%	Unclassified Contact $130/gal (3.8 l)	spray	drench?	drench?		spray

Note: Review and follow label instructions before selecting any chemical or making any application. drench? indicates it is labeled for use as a drench but is a multisite fungicide so unknown but potentially negative impact on beneficial microorganisms. Fungicides over $200 excluded. Costs based on-2016 price survey of online sources including pestrong.com and domyownpestcontrol.com.

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Table 2- Biofungicides for Various Orchid Diseases

Trade Name and Active Ingredient	Usage & Cost	Bacterial Disease (spray)	Water Molds (drench)	Fungal Root & Stem Rots (drench)	Anthracnose & Leaf Spotting (spray)	Flower Blighting (spray)
Actinovate AG *Streptomyces lydicus* red	Spray or Drench $94/18 oz	*Erwinia* *Pseudomonas*	*Phytophthora*	*Fusarium* *Rhizoctonia*	*Anthracnose*	*Botrytis*
Cease *Bacillus subtilis* MBI713	Spray or Drench $70/gal	*Erwinia* *Pseudomonas*		*Fusarium* *Rhizoctonia*	*Anthracnose* *Cercopora*	*Botrytis*
Companion *Bacillus subtilis* GB03	Drench $50/qt		*Pythium* *Phytophthora*	*Fusarium* *Rhizoctonia*		
Mycostop *Streptomyces griseoviridis* Strain K61	Spray or Drench $16/2 gram		*Pythium* *Phytophthora*	*Fusarium* *Rhizoctonia*		*Botrytis*
PlantShield *Trichoderma harzianum* Rifai strain T22	Spray or Drench $200/3 lb		*Pythium*	*Fusarium* *Rhizoctonia*		*Botrytis*
RootShield *Trichoderma harzianum* T22	Drench or Incorporate $22/4 oz		*Pythium*	*Fusarium* *Rhizoctonia*		
RootShield Plus *Trichoderma harzianum* T22 *Trichoderma virens* G41	Drench or Incorporate $127/lb		*Pythium* *Phytophthora*	*Fusarium* *Rhizoctonia*		
Serenade *Bacillus subtilis* QST713	Drench $21/32 qt		*Pythium* *Phytophthora*	*Fusarium* *Rhizoctonia*		
SoilGard 12G *Gliocladium virens* GL21	Drench or Incorporate $83/5 lb		*Pythium*	*Rhizoctonia*		
Subtilix NG *Bacillus subtilis* MBI600	Drench $263/2 oz		*Pythium*	*Fusarium* *Rhizoctonia*		
Triathlon B *Bacillus amyloliquefaciens* 747	Spray or Drench $106/gal	*Erwinia* *Pseudomonas*	*Pythium* *Phytophthora*	*Fusarium* *Rhizoctonia*		*Botrytis*

Note: Review and follow label instructions before selecting any chemical or making any application. Biofungicides are considered to be more effective when applied prior to disease occurrence to help prevent infection. Information extracted from the product labels. Costs based on 2016 price survey of online sources including pestrong.com, domyownpestcontrol.com, amazon.com and ebay.com.