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**101. Mode-of-action group 11: strobilurins.** Chase, A. R. Greenhouse Management and Production 30(1):20, 22-24. 2010.

By A.R. Chase

## Mode-of-Action Group 11: STROBILURINS

This is the first of a 6-part series detailing mode-of-action groups for disease control comparing relative efficacy, resistance and phytotoxicity characteristics.

Strobilurin fungicides were first introduced to the ornamental industry in 1998 when kresoxim methyl (Cygnus) was registered. Since then, four more active ingredients have been registered for use on ornamentals. Fluoxastrobin (Disarm O) has been the most recent strobilurin fungicide labeled for ornamentals.

The mode of action group for strobilurins is 11. Due to the rather narrow action of strobilurins, resistance is a major concern. Resistance to azoxystrobin developed before the product was labeled for use in some countries. This was due simply to the experimental testing of the fungicide that had to be done for labeling. Resistance has not been proven in any ornamental system that I am aware of, but it has clearly been shown in turf.

In a pre-emptive move the international plant protection chemical community established guidelines for labeling all strobilurin fungicides as well as others determined to be at high risk of resistance development. The Fungicide Resistance Action Committee (FRAC) meets regularly to reassess these guidelines and related topics.

### Range of efficacy

These fungicides are a good example of a range of efficacy based on whether or not the active ingredient is systemic and/or redistributes across the leaf surface once it is applied. Compass O and Cygnus each redistribute in the air while Heritage and Disarm O each have a high degree of systemic action in the xylem. The final active ingredient

**Table 1. Comparison of strobilurins fungicides labeled for ornamentals.\***

Fungicide	Manufacturer	Active ingredient	Action	Spray	Crown-directed	Drench	Re-entry interval	Chemigation
Compass O 50WDG	Bayer, OHP	Trifloxystrobin	Translaminal, redistributes on surface, protective and curative.	Yes		Yes	12 hours	No
Cygnus	BASF	Kresoxim methyl	Protective and curative	Yes	No	No	12 hours	No
Disarm O 480SC	Arysta, OHP	Fluoxastrobin	Xylem systemic	Yes	Yes	Yes	12 hours	Yes
Heritage 50WDG	Syngenta	Azoxystrobin	Upwardly systemic, curative	Yes	Yes	Yes	4 hours	Yes; but no ultra low volume application
Insignia 20WDG	BASF	Pyraclostrobin	Translaminal, long-term control	Yes	Yes	Yes	12 hours	Yes

\* Table is based on information found on product labels.

**Table 2. Results of strobilurin fungicide efficacy trials at Chase Horticultural Research Inc. (1998 to present).**

Disease	Compass O	Cygnus	Disarm O	Heritage	Insignia
Alternaria	Good/excellent	Very good		Very good/excellent	Very good/excellent
Botrytis	Very good	None/some	None/some	Fair/good	Poor/very good
Cercospora	Some/excellent	Excellent	Very good/excellent	Very good/excellent	Very good/excellent
Colletotrichum			Excellent	None/very good	None/some
Coniothyrium				Some	None/good
Cylindrocladium	Some/good			Very good	Good/excellent
Downy mildew	Good/very good	Some/excellent		Very good/excellent	Good/excellent
Fusarium	Some/good		None/some	Good/very good	Good/very good
Gliocladium	Very good/excellent			Good/excellent	Very good
Myrothecium	Some/good	Good	Very good/excellent	Very good/excellent	Very good/excellent
Phyllosticta	None			None/good	Some/excellent
Phytophthora	None/very good			Very good	None/excellent
Powdery mildew	Very good/excellent	Very good/excellent		Very good/excellent	Good/excellent
Pythium	Poor/good			Some/very good	Good/excellent
Rhizoctonia	Good	None/very good	Good	Very good/excellent	Very good/excellent
Rust	Fair/excellent	Some/excellent		Excellent	Very good
Scab	Excellent	Excellent		Very good/excellent	Excellent
Sclerotinia	Very good/excellent	None		Very good	Very good
Thielaviopsis	None			None	

Colored boxes indicate consistent, high level control results for a particular disease.

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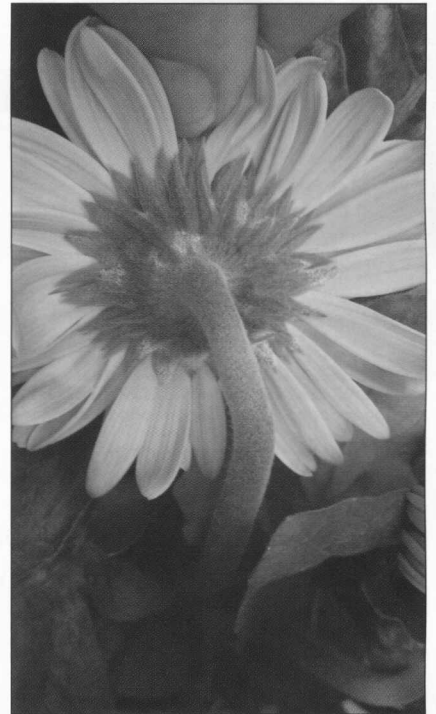
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is pyraclostrobin, which is in Insignia and Pageant, and is not systemic and does not redistribute in the air. Pageant provides a broader spectrum of control with the addition of boscalid (mode-of-action group 7).

Another active ingredient with the same mode-of-action group (11) is fenamidone (FenStop), which has a reduced range of efficacy and is not a strobilurin. FenStop is labeled for downy mildew, Phytophthora and Pythium.

All of the strobilurins are labeled for



Powdery mildew on a gerbera flower.

spray applications with most also labeled for crown-directed sprays and drenches. The re-entry interval is 12 hours for all except Heritage which has a 4-hour re-entry interval. Some of these products are also labeled for chemigation. There is a special prohibition on the Heritage label against use in ultra low volume application equipment.

With many similarities on their labels, you may be wondering if you can substitute the fungicides in the same chemical class and obtain equal results. In some cases, the chemical properties of a particular active ingredient are distinct and give the product an advantage over others with the same mode-of-



Rust on dianthus.

action. In other cases, fungicides with the same mode-of-action have proven similar in activity, at least against some target disease pathogens.

### Diseases controlled

Target diseases for nearly all strobilurin fungicides include downy mildew, rust, powdery mildew and many leaf spots (*Alternaria*, *Cercospora*, *Myrothecium* and *Sphaceloma*, which causes scab on poinsettia). Heritage and Insignia also provide good to very good control of soil-borne diseases such as *Fusarium*, *Cylindrocladium* and *Rhizoctonia* stem and root rots, but not black root rot (*Thielaviopsis*).

The most consistent and effective control of rust is seen with Heritage. Be sure to use a wetting agent if pustules have formed or the fungicide may not penetrate the pustule and control will be minimal. This may be because Heritage has a better chance to penetrate the pustule. Rust infections, as well as downy mildew, start inside the leaf and may be hard to reach with a surface active product without systemic action.

Compass O has been somewhat more effective against *Botrytis* than other strobilurins. This may be due to Com-

pass O redistributing across the leaf and *Botrytis* spores that constantly fall onto the leaves can be killed even when they land on a part of the leaf that was not originally sprayed.

Across the group of five strobilurins the most variable results were observed when they were tested against *Colletotrichum*, *Coniothyrium*, *Phyllosticta*, *Phytophthora* and *Pythium*. *Colletotrichum*, *Coniothyrium* and *Phyllosticta* fall into the anthracnose-dieback group of diseases, which can be very hard to control.

It can be difficult to obtain a good fungicide trial for *Phytophthora* and *Pythium* diseases. With *Phytophthora*, results can vary widely within the same trial with some plants dying while others that have received the same treatment being unaffected. This makes statistical analysis difficult.

*Pythium* is especially hard to evaluate. Sometimes it can be difficult to determine if the root loss was caused by *Pythium* or by fungicide phytotoxicity.

We do not have complete information for each strobilurin on each disease. Consider using one of the strobilurins in a rotational program for any of the color highlighted diseases in Table

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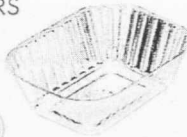
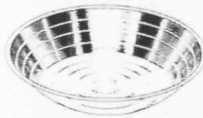
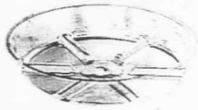
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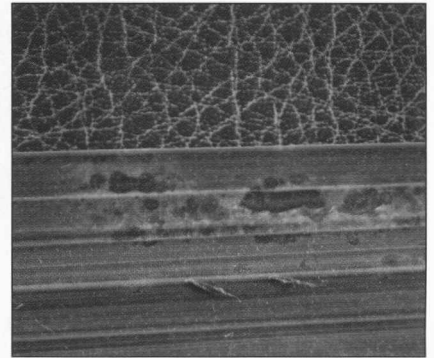
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Cercospora leaf spot on Kentia palm.

2. These products have been tested over the past 10-12 years on a wide range of plants under greenhouse and field conditions. Overall these products have been very safe. Their labels do prohibit use on specific plants so be sure to read the labels carefully.

**Real world application**

Our diagnostic lab recently received a sample of cucumbers infected with downy mildew. The grower had been rotating three different strobilurins and failed to control the disease resulting in a huge loss of yield (perhaps due to resistance development). Be sure to read and heed product labels to make sure that you are rotating between mode-of-action groups.

Strobilurin fungicides are not the answer to all disease issues despite their broad-spectrum activity. They are also not interchangeable, although clearly similar results may be obtained with several of them against a particular disease.

If you want to simplify fungicide inventory, consider keeping one strobilurin with systemic or soil-borne activity and one that is best for foliar diseases. Be sure to follow label directions and check rates of use since these fungicides do not contain equal amounts of active ingredient per unit volume. Comparing use rates and relative efficacy is the only way to determine the most cost effective fungicide for your situation.

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