

# CHASE NEWS

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CHASE HORTICULTURAL  
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## Bacterial Diseases to Watch For and Avoid

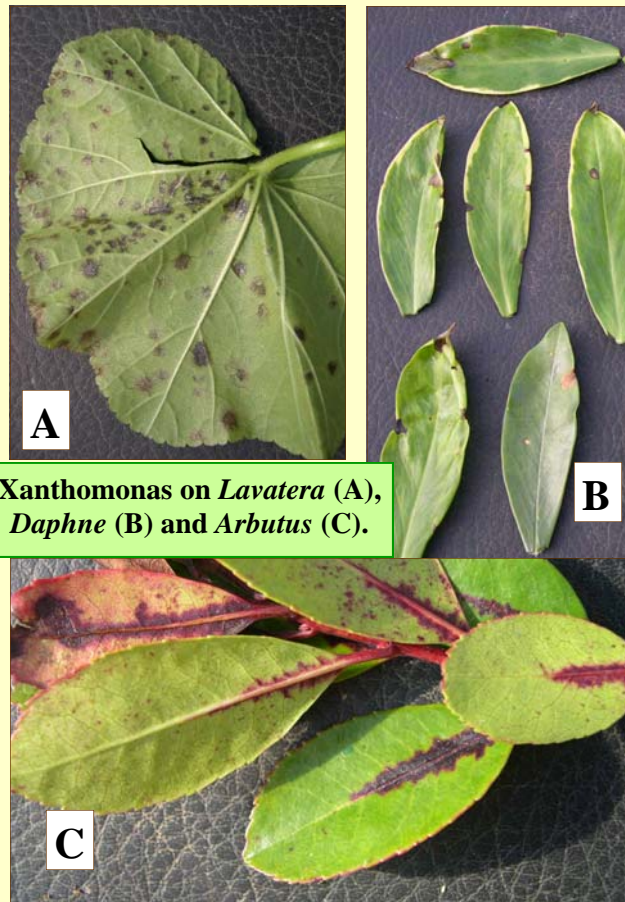
Bacterial diseases are among the most difficult to identify and control. They are present on many crops from woody crops like Arbutus, Prunus and Daphne to bedding plants like zinnia and vinca, perennials including lavender and potted flowering crops like Geranium. In the past month our diagnostic lab has received samples of each of these diseases.

There are some typical symptoms of bacterial leaf spot diseases that can help you diagnose them. Bacteria spread by water movement and enter leaves passively. That means they get in through natural opening like stomates and hydathodes (along the leaf edges) or through wounds. If free water is not present on the leaves (from rainfall or irrigation) then the bacteria cannot move or enter the leaf. When we do bacterial trials, we use overhead irrigation to promote disease.

- Spots form between leaf veins
- Water-soaked appearance
- Centers fall out
- Brightly-colored margins rare
- Spots often start on leaf edges
- No fruiting bodies present
- Concentric rings rarely form except with *Erwinia* soft rot on leaves

The most common foliar pathogens are *Pseudomonas* and *Xanthomonas*. They grow reasonably well on culture media and can be isolated by most diagnosticians. The confusing part comes when bacteria are isolated but the symptoms do not appear to be caused by bacteria. It is a real challenge at times to decide which of the many bacteria that can be present in dead spots on leaves is actually capable of causing the disease. There are some diagnostic kits for certain bacteria and fatty acid analysis that can aide in their identification. Unfortunately, we do have both *Pseudomonas* and *Xanthomonas* that are not capable of causing a disease and their detection by a lab does not insure their identity as a plant pathogen.

The best products for bacterial disease control are those containing copper (like Camelot, Kocide and Phyton 27) and Cease (previously sold as Rhapsody—*Bacillus subtilis*). Keep in mind, however, that if you can keep the leaves dry you can eliminate bacterial diseases without use of any bactericides.



**Xanthomonas on *Lavatera* (A),  
*Daphne* (B) and *Arbutus* (C).**

### Inside this issue:

Research Update—Bio-rational Products for Dogwood Diseases, Control of Black spot and powdery mildew on rose, <i>Cylindrocladium</i> leaf spot on myrtle	2
Alternaria Leaf Spot Control	3
More Work on Post-harvest Botrytis Control with Pageant	4
Products in Review—Camelot	5

Research Results—Foliar Diseases

**Bio-Rational Products for Dogwood Diseases**

Over the past ten years or so, there has been a real growth in the interest and development of “green” products including those with reduced risk like the strobilurins, bio-rational products like essential oils and true biological products like Cease (originally called Rhapsody). Hagan and Akridge (Auburn University) reported on some work with bio-rational fungicides for dogwood foliar diseases last September.

Neem Concentrate, SunSpray Ultra Fine Oil and Rhapsody (*Bacillus subtilis*) were compared to some synthetic fungicides (Eagle [myclobutanil], Immunox [myclobutanil], Liquid Systemic Fungicide [propiconazole] and 3336 [thiophanate methyl]) for spot anthracnose, *Cercospora* leaf spot and powdery mildew. Trials were conducted for three years in a landscape setting. Many of the products chosen are registered for landscape use.

In general, the synthetic fungicides gave superior control to the bio-rational products in this trial. Powdery mildew (*Erysiphe pulchra*) was effectively controlled with the bio-rational fungicides in 2003 and 2004, when they were applied weekly, that was equal to that achieved with the synthetic fungicides. When powdery mildew pressure was severe in 2005 the bio-rational products did not perform as well. Spot anthracnose (*Elsinoe corni*) was most effectively controlled with the synthetic fungicides and even showed some carry-over benefit from one season into the next. Control of *Cercospora* leaf spot (*Pseudocercospora cornicola*) was moderate with all synthetic products and lower but significant with the bio-rational products. For a complete report see—Journal of Environmental Horticulture 25(3):157-165.

**Control of Rose Black Spot and Powdery Mildew**

New fungicides always receive a lot of attention when they are under development and soon after registration. In late February, Pageant (pyraclostrobin and boscalid from BASF Corp.) was registered federally. We have worked a lot on this new combination product but have never worked on



black spot on rose. In the past two years, Mulrooney (University of Delaware) has reported on his trials with rose diseases. Insignia was not very effective in 2006 at the rates tested and was not included in 2007. The best control

of black spot in both years was achieved with Eagle 40WP although the 12.5 oz rate of Pageant was almost as effective in both years. Powdery mildew pressure was low and Eagle was again the best product. For complete reports on these trials see: *F & N Trials on the Plant Management Network* or contact me directly.

**Cylindrocladium Leaf Spot on Myrtle**

Early this year we started a trial on myrtle cuttings (*Myrtus communis*). The plant is used for cut foliage but some cultivars are used as landscape material. In a dry climate the crop does not develop leaf spots but during propagation a normally soil-borne stem and root rot pathogen can also cause leaf spot. This pathogen is *Cylindrocladium pauciramosum*.

Treatments were applied as sprays on 14, 21 and 28 January. Two of the treatments (STBX-013 and ZeroTol) were applied three days in a row and then weekly. Exact treatments are shown in the table to the right. The best control was found on cuttings treated with

Treatment	Rate/100 gal	No. spots
Noninoculated	—	1.1
Inoculated	—	3.9
Terraguard SC	4 oz	4.2
Terraguard SC	8 oz	2.4
ZeroTol	1% 3 days, then 0.33% weekly	4.2
STBX-013	0.2% 3 days, then 0.07% weekly	2.7
Phyton 27	25 oz	1.3
STBX-016B	25 oz	3.2
KleenGrow		2.7

Phyton 27 or Terraguard SC at 8 oz. STBX-013 appeared to be a little more effective than ZeroTol (similar chemical class). KleenGrow (available from PACE 49) was also somewhat effective in preventing *Cylindrocladium* leaf spot on myrtle in this trial. Many other products are effective on *Cylindrocladium* leaf spot but it is good to know that “green” products like KleenGrow and STBX-013 can also help.

Treatment	Rate/100 gal	Black Spot Control 2006	% Black Spot 2007	% Powdery Mildew 2007
Water	—	9.3 f	90 d	8 bc
Insignia	4 oz	8.0 e	Not tested	Not tested
Insignia	8 oz	6.3 d	Not tested	Not tested
Pageant	8 oz	5.5 c	4 bc	5 ab
Pageant	12.5	3.5 b	1 ab	8 bc
Eagle	6 oz	2.2 a	0 a	2 a

In 2006 black spot was rated as follows: 1(0%), 2(0-3%), 3(3-6%), 4 (6-12%), 5(12-25%), 6(25-50%), 7(50-75%), 8(75-87%), 9(87-94%), 10(94-97%), 11 (97-100%) and 12 (100%) infected or defoliated.

## Alternaria leaf spot Control

We have been testing some industry standards as well as experimental formulations for efficacy against a wide range of fungal pathogens including *Alternaria*. This month, we report on two trials on *Alternaria*. The first was preventative and performed at Mt. Aukum on double impatiens. The second was performed in a cut flower range in San Diego County using *Alstroemeria* that were naturally infected with *Alternaria* (photo to right).



### **Alternaria leaf spot on *Alstroemeria***

The second *Alternaria* leaf spot trial was conducted in San Diego County by Buzz Uber. Applications were made on a weekly interval starting on 15 January (as much as possible), 5, 12, 18 and 26 February and 3 March. Specific treatments and rates (in oz per 100 gal) are given in the graph below. Each treatment included the adjuvant Super 7 at 4 oz/100 gal. On March 12, the number of *Alternaria* leaf spots per 20 foot plot was estimated.

### **Alternaria leaf spot on Impatiens**

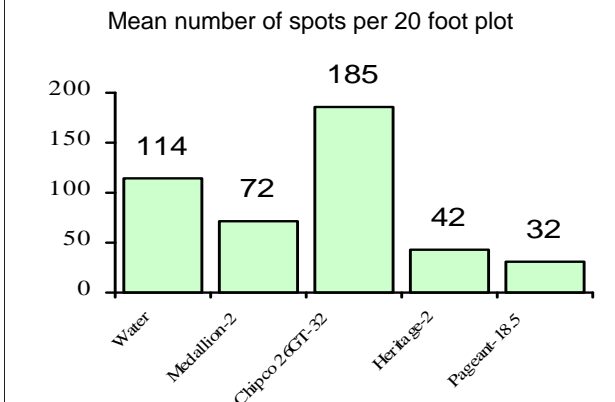
Plants were treated weekly with the exception of STBX-013 (an experimental product in the same chemical group as ZeroTol under development by Phyton Corporation) and ZeroTol. In their cases, they were applied at a higher rate three days in a row and then at a lower rate (33%) on a weekly interval. The first treatment was applied on 11 February and the final one on 25 February. The fungicides chosen and rates of use are given in the table to below. They represent 6 separate chemical classes. The number of spots per plant was recorded on 5 March.

All of the treatments gave exceptional control of *Alternaria* on *Impatiens* with Medallion at 1 oz/100 gal resulting in 100% prevention. It was interesting to see excellent control provided with both STBX-013 and ZeroTol although the ZeroTol did cause slight burning on the crop.

*Alternaria* leaf spot was not evenly distributed between the plots but we did see overall that Chipco 26GT made the spot worse than spraying with water. Statistically all treatments, except for the Chipco 26GT, were the same. The lowest number of spots were found in plots treated with either Heritage and Pageant. There were no signs of any phytotoxicity in this trial. Special thanks to Buzz Uber, Mellano and Company and BASF Corporation for their combined efforts in performing this trial.

Treatment	Rate/100 gal	No. spots on Impatiens
Water noninoculated	—	0.2 a
Water inoculated	—	11.0 b
Eagle 40	4 oz	0.3 a
Heritage	4 oz	0.7 a
Chipco 26019	16 oz	0.1 a
Medallion	1 oz	0 a
Phyton 27	25 oz	0.2 a
STBX-013	0.2% three days then 0.07% weekly	1.2 a
ZeroTol	1% three days then 0.33%	0.4 a

Numbers in the column followed by the same letter are not significantly different (Student-Newman-Keuls method)



<b>Top Alternaria Fungicides</b>
Iprodione (Chipco 26019 and Chipco 26GT)
Sterol inhibitors (Banner MAXX, Eagle, Strike, Terraguard)
Strobilurins (Compass O, Cygnus, Heritage, Insignia, Pageant)
Fludioxinil (Medallion, Palladium)
Chlorothalonil (Daconil Ultrex, Spectro)

## More Work on Post-Harvest Botrytis Control with Pageant

In January, we reported on a test using Rhapsody (now called Cease and marketed by BioWorks) showing efficacy in post-harvest control of Botrytis on Liatris. Since then, we have done two more trials and we report them here. Both trials were once again in San Diego County using freshly harvested Liatris as well as wax flowers in the first trial. Bunches were harvested on day one, dipped on day 2, immediately placed in cold storage overnight and then shipped to our Mt. Aukum facility on day 3. We received them on day 4 and they were placed in buckets of water to test Botrytis development as well as vase life.

The treatments were: no dip, water, Decree (24 oz/100 gal), Insignia (16 oz/100 gal), and two rates of the newly registered Pageant (12.5 and 18.5 oz/100 gal). Pageant was registered by BASF Corporation in late February throughout most

### Botrytis Control on Cut Flowers—test 2

Treatment	Rate/100 gal	Wax flower	Liatris
No dip	—	9.2 d	7.5 c
Water	—	5.8 c	5.9 c
Decree	24 oz	0.1 a	2.6 b
Insignia	16 oz	3.7 b	5.7 c
Pageant	12.5 oz	1.0 a	1.2 ab
Pageant	18.5 oz	1.9 a	0.1 a

The number of Botrytis spots per bunch (10 stems each) was recorded on 6 or 7 February. Numbers in the same column followed by the same letter are not significantly different (Student-Newman-Keuls method)

of the US. It is a combination of the active ingredient in Insignia (pyraclostrobin—also from BASF) and boscalid (not registered for our industry). The dipping process was simply that and not a soak. Excess solution was shaken off and bunches placed in buckets with water overnight at 34–36 F. We did not see any Botrytis on the flowers when they were received and they were subsequently inoculated with spores of the *Botrytis cinerea* about 6 days after we received them. We rated Botrytis severity 8 days after inoculation. The results are shown in the table above (test 2). Botrytis was rated by recording the number of spots of active sporulation. There were ten stems per bunch and a total of ten bunches per flower type per treatment.

The grower standard, Decree was the most effective treatment in the wax flower but was significantly less effective than Pageant on the Liatris. Insignia alone as better than the water treated wax flower but was not

better on the Liatris. The best overall treatment on both flowers was Pageant used at 12.5 or 18.5 oz/100 gal.

These results were very promising and we decided to perform another test using Pageant at 18.5 oz/100 gal compared to water treatment and the grower standard (Decree at 24 oz/100 gal). The trial was performed using Ranunculus, Liatris, wax flower and Genista. Five bunches of each flower type were left noninoculated to test affects of the treatments on vase life of the flowers without interference of the Botrytis. The other five bunches were inoculated. Results of the Botrytis severity are shown in the table below.

The best prevention of Botrytis was found when flowers were dipped in Pageant (C) in this trial. Decree provided very similar control on all flowers except for the Liatris where it failed (B). Water is (A) in the image below.



The bunch quality was evaluated on 7 March and showed that both fungicides caused a loss of quality on Genista and wax flower. This was not seen on Ranunculus or Liatris. At the final rating, the effect was no longer evident as all flowers that were not inoculated appeared of similar quality.

### Botrytis Control on Cut Flowers—test 3

Treatment	Rate/100 gal	Wax flower	Liatris	Ranunculus (no./bunch)	Genista
Water	—	2.0 a	4.4 b	4.2 b	4.6 b
Decree	24 oz	1.6 a	4.8 b	1.0 a	3.5 a
Pageant	18.5 oz	1.4 a	1.2 a	0.4 a	3.1 a

The severity of Botrytis was recorded on 7 March using the following scale (except on ranunculus): 1 (none), 2 (slight, 3 (moderate), 4 (severe) and 5 (100% affected). Numbers in the same column followed by the same letter are not significantly different (Student-Newman-Keuls method)

## Products in Review—Camelot

It is tempting sometimes to simplify things like what products can be used for each disease. Since there are very few products that will affect bacterial diseases, except those with copper, it can seem that the only use for copper products like Camelot will be bacterial diseases.

Our trials with Camelot over the past 10 years have shown that copper-containing products can be effectively used for a very wide range of diseases that commonly attack ornamentals. The table to the right shows results of our trials at Chase Horticultural research using Camelot. The product was applied most often as a preventative at 16 to 48 oz/100 gal. Although the lowest labeled rate of Camelot is 48 oz per 100 gal, many of our trials have shown that 16 oz/100 g gal can be as effective. Camelot has given very good control for downy and powdery mildews as well as some fungal leaf spots like scab on poinsettia.

Another newer use will be for Pythium root rot on a variety of bulbs and bedding plants. We have seen some control when Camelot was used as a potting medium drench at 16 oz/100 gal. As always read the product label and follow the labeled rates, application intervals and use sites. Remember that copper is not just for bacteria!

Pathogen	Plants Tested	Resulting Control
Alternaria leaf spot	Impatiens	Good
Anthracnose (Colletotrichum)	Cordyline	Good
Bacterial leaf spots (Pseudomonas and Xanthomonas)	Delphinium, Impatiens, Ranunculus, Snapdragon and Verbena	Good
Botrytis blight	Cyclamen, Geranium, Gerber daisy and poinsettia	Fair
Cylindrocladium cutting rot	Azalea	Some
Downy mildew	Alyssum and Pansy	Poor to very good
Phytophthora aerial blight	Spathiphyllum	Poor to good
Powdery mildew	Gerber daisy, Hydrangea, Mint and Snapdragon	Poor to very good
Pythium root rot	Asiatic lily, Calla lily, Lisianthus and Snapdragon	Some
Rhizoctonia cutting rot or stem rot	Poinsettia and Vinca	Poor to some
Rust	Rose and Snapdragon	Poor to some
Scab (Sphaceloma)	Poinsettia	Very good to excellent
Sclerotinia blight	Petunia	None



Powdery mildew on rose (a), downy mildew on stock (b) and Xanthomonas on lavender (c).

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