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CHASE RESEARCH GARDENS, INC.

CHASE NEWS

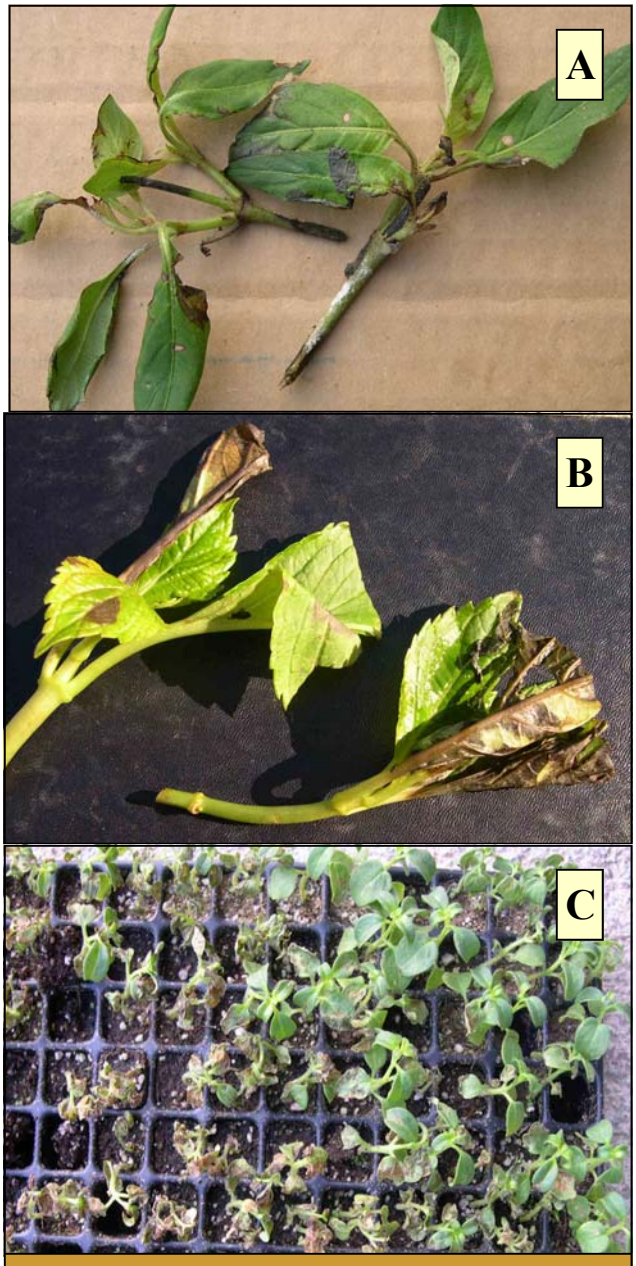
More Problems with Propagation

One of the best trends I have seen is the increasing number of samples we receive for diagnosis of propagative materials like plugs and unrooted cuttings compared to finished products. Starting at this stage is the best way to stop the movement of diseased plants from one stage to another.

In the past 6 weeks we have seen some new diseases like Alternaria leaf spot and stem rot on pentas cuttings (A), anthracnose on hydrangea cuttings (B) and Xanthomonas blight on snapdragon plugs (C). Some of the other propagation diseases to watch out for right now include *Pythium* on *Ficus* and *Phytophthora* on poinsettia, bacterial infections on lavender (*Xanthomonas*), on *Dieffenbachia* (*Erwinia*) and anthracnose on Camellias. Many of these diseases continue to plague production months and even years after they have left the propagation phase. This is a good example of "pay me now or pay me later". Unfortunately, if you decide to pay later you will be using more product and inevitably have more losses due to the disease.

Some crops seem to have disease issues from the very beginning. For these you can employ a routine fungicide application. Since most fungicides can affect rooting in a few crops, it is important to know what disease is causing the problem. This is the only way to make sure that you do not apply more products than absolutely necessary and it will allow you to avoid applying costly products that are not needed.

Some products are best applied as a spray on stock plants the day before cuttings are harvested. In other cases, a soak (dip) can be effective. See page 2 for results of a trial on strawberry runners. Page 3 also reports results of two trials on propagation diseases we finished this month. The good news is that there are usually only one or two diseases common to a given ornamental. You can learn these as well as the most effective controls that will not result in delayed rooting.



A-Alternaria on pentas, B-anthracnose on hydrangea and C-Xanthomonas blight on snapdragons.

Inside this issue:

Powdery Mildew Review—Recent Trials

Powdery mildew trials are always in demand and unfortunately, nearly always difficult to accomplish. They are some of the longest trials we perform, with some lasting more than 5 months.

The table to the right shows a summary of several trials completed in the past twelve months. We performed trials on crape myrtle, gerber daisy, miniature rose, rosemary and zinnia. Some of the fungicides were tested against a single powdery mildew while others were used in several trials. All trials were treated on a 14-day interval except for the zinnia trial which was sprayed on a 21-day interval.

Industry standards in the sterol inhibitors group (Banner MAXX and Rubigan) provided excellent control of powdery mildew. Concert is a combination of Banner MAXX and Daconil that is being developed for ornamentals by Syngenta. Another important chemical group is the strobilurins including Compass O, Cygnus, Heritage and Insignia (not labeled for ornamentals yet). Insignia is under review at EPA and will be sold to ornamental producers by BASF. These products provided some to excellent control.

The other chemical group of interest in these trials is the phosphonates (phos acid alternatives) including Aliette, Alude, Fosphite and pHortress. Each of these products gave very good control of powdery mildew with the exception of Aliette which gave poor or no control. Remember that not all phosphonates are registered as fungicides (pHortress is labeled as a fertilizer). Unless they have an EPA fungicide registration you cannot legally apply them for the express purpose of disease control. Be sure to follow fungicide labels for legal use rates, intervals and crops in your state.

Product	oz/100 gal	Efficacy	Crop
Actinovate	6	Some	Rosemary
Aliette	16	None	Rosemary
Alude	64	Very good	Rosemary
Banner MAXX	6 oz	Excellent	Zinnia
Compass O	1-2	Some to very good	Rosemary, Crape myrtle
Concert	16	Excellent	Crape myrtle
Cygnus	3.2	Very good to excellent	Rosemary
Fosphite	24	Very good	Rosemary
Heritage	1-2	Some to very good	Rosemary, Zinnia
Insignia	4-16	Some to excellent	Crape myrtle, Gerber daisy, Rosemary
pHortress	64	Very good	Rosemary
Phyton 27	15	Good	Miniature rose
Rhapsody	128	Good	Rosemary
Rubigan	5-10	Excellent	Crape myrtle, Gerber daisy
Terraguard	8	Good to very good	Crape myrtle, miniature rose

Powdery mildew on *Geranium* sp.

Dipping Strawberry Liners

Among growers, dipping is a popular means of applying fungicides to cuttings. I have been pretty SUBTLE about how much I am against this practice. I have seen diseases like Cylindrocladium on miniature rose and Fusarium on dieffenbachia. Sprenching stuck cuttings instead has been more successful in my experience.

However, I recently read an article on dipping strawberry liners to reduce severity of anthracnose. The work was performed by University of Florida researchers, J. Mertely and N. Peres. Strawberry liners may be infected with *Colletotrichum acutatum* showing symptoms of petiole lesions as well as root rot. A 5 minute dip with azoxystrobin (Heritage for ornamentals), hydrogen peroxide (Oxidate) or a combination of cyprodinil and fludioxinil (a combination under development called Palladium for ornamentals). Some benefits were seen with the Palladium which had a significantly higher yield of fruit.

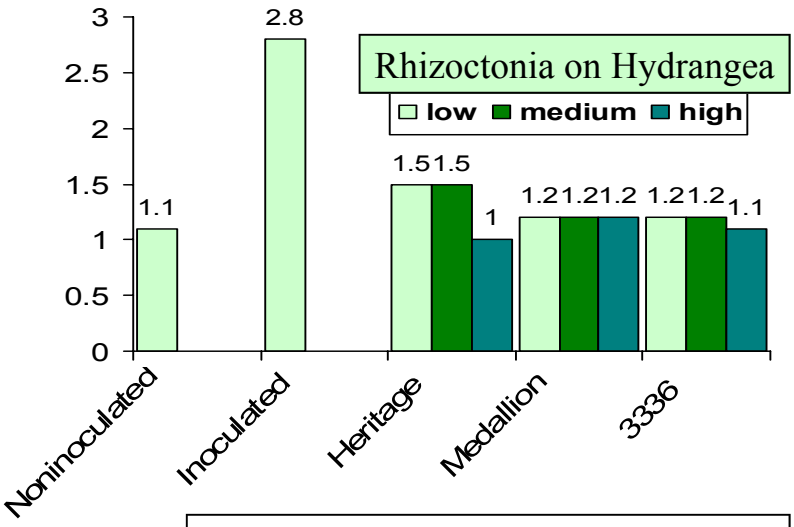
In a second trial, plants were naturally infected with Botrytis and results were a little different. More plants died in the control (25%) and hydrogen peroxide (44%) treatments than the Heritage (6%) and Palladium (7%) treatments. Both Heritage and Palladium gave significantly higher yields than the controls in this trial. Despite some positive results, these researchers conclude that it is not a good idea to routinely dip strawberry plants unless the specific cultivar is known to be very susceptible to a particular disease. For a full report see Florida Grower—October 2005.

Trial Update—Does Rate Matter?

Rhizoctonia cutting rot on Hydrangea

We ran one more trial on hydrangea cutting rot last month. Since Heritage, Medallion and 3336 were very effective in earlier trials this year we tested their lower limits of efficacy using three rates. Heritage and Medallion were each sprayed at the base of the cuttings once before inoculation at 0.5, 1 or 2 oz/100 gal. We applied 3336 in the same way but used rates of 8, 12 and 16 oz/100 gal. Symptoms appeared about 10 days after we inoculated the cuttings. As the temperatures have been dropping we saw a drop in symptom severity (1=none, 2=slight to 5—dead).

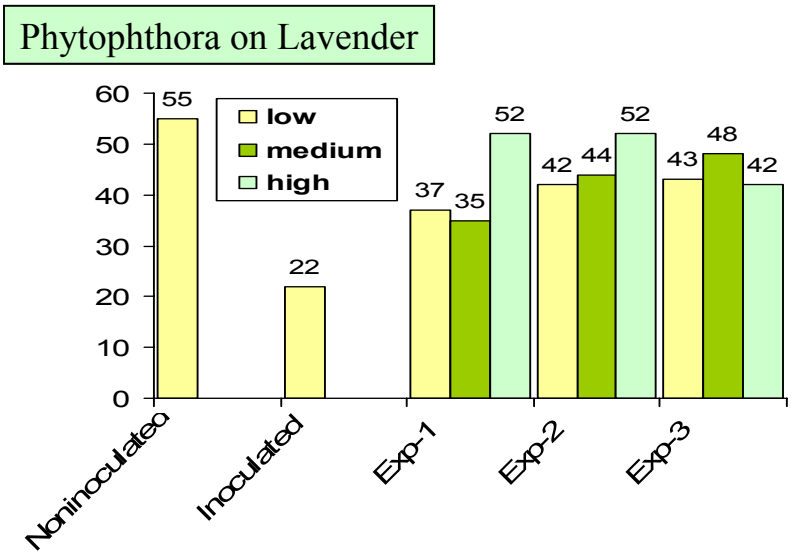
Results showed that Heritage was slightly more effective at 2 oz/100 gal than it was at 0.5 or 1 oz but Medallion and 3336 gave the same degree of control regardless of rate. Under higher disease pressure slight differences are important. This is one of the reasons that fungicides have a range of rates on their labels.



Phytophthora root rot control on Lavender

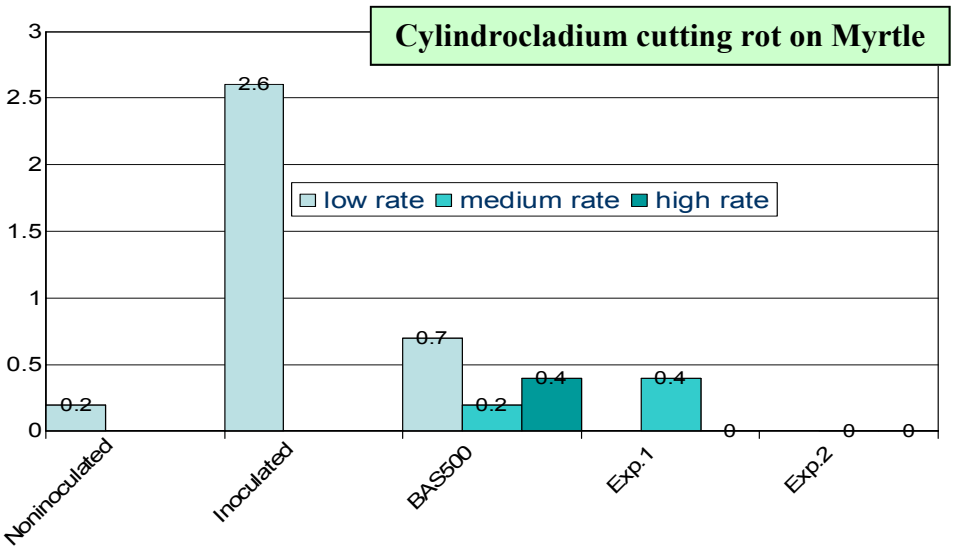
We have been seeing lavender, salvia and rosemary cultivars with sudden death, especially in the summer months. These crops do not typically grow well with the high water and fertilizer levels used to produce them and may succumb to Phytophthora root or crown rot. This year we performed a trial on three new experimental products under evaluation for Phytophthora root rot on ornamentals. The protocols called for three rates of each product applied on a monthly interval as soil drenches.

The graph to the left shows the percentage of healthy appearing roots we found when we examined them after three fungicide applications. All rates of the three experimental products were better than the inoculated controls (average of 22% roots). It was interesting to see that the highest rate tested was very effective for experimental 1 and 2 (52% roots at the highest rate) but not necessarily for experimental 3. This type of rate bracketing is common during the experimental phase of product evaluation and it is clear that it is needed for accurate label development.



Cylindrocladium cutting rot on Myrtle

We recently finished a trial with BAS500 and two experimental compounds for prevention of Cylindrocladium cutting rot on myrtle. Cuttings were stuck in perlite and fungicides applied as a sprench once before inoculating with *C. pauciramosum*. The graph to the right shows the results of testing two or three rates of each product. The medium and high rates of BAS500 were equally effective and a little better than the low rate. For one of the experimental fungicides, the high rate was better than the medium rate but for the other product both rates were 100% effective.



BIOLOGICALS FOR DISEASE CONTROL

The idea to review biological products for ornamental disease control started when I received the 2005 volume of the Annual review of Phytopathology. This book is published every year with a wide variety of chapters or reviews on key issues in plant pathology. This year Margery Daughtrey (Cornell University) and Mike Benson (North Carolina State University) wrote a chapter on disease control in ornamentals.

The table to the right is their summary of the published research on biological control products in ornamentals. They do not include all registered products which probably means that they did not find published research on all of these products. Some of the other products registered on ornamentals include the following: Galltrol and Nogall (*Agrobacterium radiobacter*), Ecoguard (*Bacillus licheniformis*), Taegro (*Bacillus subtilis*), Aspire (*Candida oleophila*), AtEze (*Pseudomonas chlororaphis*) and Sporodex (*Pseudozyma flocculosa*).

I was a little surprised to see all of the reported failures of products that we have worked with obtaining some success. Most of our experience has been with RootShield/PlantShield, Rhapsody and Actinovate (*Streptomyces lydicus*). Our most successful trials with RootShield/PlantShield have been for control of Pythium and Rhizoctonia root rots. We do not see as much success with Fusarium but at times the product works well. RootShield (*Trichoderma*) works best on root diseases and that if the problem occurs on stems (like Rhizoctonia cutting rot) or above ground (like Phytophthora aerial blight) the fungus will not be as effective.

Actinovate has been moderately successful in controlling Botrytis blight, powdery mildew and Pythium root rot. In other trials, we did not see significant control of downy mildew, Rhizoctonia cutting rot or rust.

We have recently seen some interesting results with Actinovate for control of Fusarium root rot on Douglas fir seedlings. While the 6 oz rate of the product did not reduce colonization of the roots by *Fusarium*, the 12 oz rate reduced recovery by 60% compared to that of the untreated plants. We are hoping to evaluate this rate response in an upcoming trial. We actually isolated the active ingredient, *Streptomyces* from the roots of Douglas fir. I believe we will include culturing from the roots in our next efficacy trial for *Fusarium*. Actinovate is labeled for bulb soaks (6-18 oz/100 lbs of bulbs). Since there are a number of bulbs affected by Fusarium (gladiolus, freesia and Dutch iris) we plan trial Actinovate for this use. Finally, *Streptomyces* spp. have been effective as seed treatments for some diseases and we plan to evaluate Actinovate as a seed treatment in the upcoming months.

Product	Agent	Disease	Crop	Reported efficacy
AQ-10	*Ampelomyces quisqualis*	Powdery mildew	Poinsettia	No
Companion	*Bacillus subtilis*	Pythium Rhizoctonia Fusarium	Geranium Vinca Gladiolus	No No No
Deny	*Burkolderia cepacia*	Fusarium	Gladiolus	No
Mycostop	*Streptomyces griseoviridis*	Botrytis Thielaviopsis Fusarium Phytophthora Pythium	Geranium Pansy Gladiolus Snapdragon Geranium	No No No No No
PlantShield	*Trichoderma harzianum*	Pythium Rhizoctonia Phytophthora Pythium	Geranium Vinca Snapdragon Caladium	No No No No
Primastop	*Gliocladium catenulatum*	Rhizoctonia Thielaviopsis Phytophthora Pythium	Vinca Pansy Snapdragon Geranium	Yes No No No
RootShield	*Trichoderma harzianum*	Cylindrocladium Fusarium Pythium Rhizoctonia	Myrtle Gladiolus Geranium Bedding plants (impatiens, begonia, petunia and vinca)	Yes No Yes (2/6 tests) No (5/5 tests)
Rhapsody	*Bacillus subtilis*	Pythium Botrytis Powdery mildew Alternaria Powdery mildew Cercospora	Geranium Geranium Poinsettia Marigold Hydrangea Pansy	Yes No No Yes (1/2 tests) Yes Yes
SoilGard	*Trichoderma virens*	Pythium Fusarium Rhizoctonia	Geranium Gladiolus Bedding plants (vinca, New Guinea impatiens, begonia, impatiens, petunia, zinnia)	No No Yes (2/8 tests)
Subtilex	*Bacillus subtilis*	Thielaviopsis Fusarium	Pansy Gladiolus	No No

Daughtrey, M. L. and D. M. Benson. 2005. Principles of healthy management for ornamental plants. Annual Review of Phytopathology 43:141-169.

POWDERY MILDEW HOSTS

compiled by Sue Harris

Plant Genus	Common Name	Powdery Mildew Species
Abelmoschus	Silk flower	Erysiphe cichoracearum
Achillea	Yarrow	Erysiphe cichoracearum, Erysiphe communis
Ageratum	Floss flower	Erysiphe cichoracearum
Ajuga	Carpet Bugle	Erysiphe cichoracearum
Alcea	Hollyhock	Erysiphe cichoracearum
Anemone	Wind Flower	Erysiphe communis, Erysiphe polygoni
Antirrhinum	Snapdragon	Erysiphe cichoracearum, Oidium spp.
Aquilegia	Columbine	Erysiphe communis, Erysiphe polygoni
Arabis	Rockcress	Erysiphe polygoni
Artemisia	Wormwood	Erysiphe cichoracearum
Asclepias	Butterfly Weed	Erysiphe cichoracearum, Sphaerotheca sparsa
Aster	Aster	Erysiphe cichoracearum
Begonia	Begonia	Erysiphe cichoracearum, Erysiphe polygoni, Oidium begoniae
Calendula	Calendula	Erysiphe cichoracearum, Erysiphe polygoni
Callistephus	China Aster	Erysiphe cichoracearum, Erysiphe polygoni
Campanula	Bellflower	Erysiphe cichoracearum
Capsicum annuum	Pepper	Erysiphe cichoracearum, Leveillula taurica
Centaurea	Bachelor's Button	Erysiphe cichoracearum
Chelone	Turtlehead	Erysiphe cichoracearum
Chrysanthemum	Mum	Erysiphe cichoracearum
Cirsium	Bull Thistle	Erysiphe cichoracearum
Clarkia	Godetia	Erysiphe cichoracearum
Coreopsis	Tickseed	Erysiphe cichoracearum, Sphaerotheca macularis
Cosmos	Cosmos	Erysiphe cichoracearum
Cuphea	Cigar Plant	Erysiphe polygoni
Cynoglossum	Chinese Forget-Me-Not	Erysiphe cichoracearum
Dahlia	Dahlia	Erysiphe cichoracearum, Erysiphe communis, Erysiphe polygoni
Delphinium	Larkspur	Erysiphe cichoracearum, E. polygoni, Sphaerotheca fuliginia, S.macularis
Erigeron	Fleabane	Erysiphe cichoracearum, Sphaerotheca fuliginia, Sphaerotheca macularis
Eriogonum	Wild Buckwheat	Erysiphe californica, Erysiphe cichoracearum, Erysiphe polygoni
Erysimum	Wallflower	Erysiphe polygoni
Euphorbia	Poinsettia	Erysiphe euphorbiae, Oidium spp.
Gaillardia	Blanket Flower	Erysiphe cichoracearum, Sphaerotheca fuliginia, Sphaerotheca macularis
Galium	Sweet Woodruff	Erysiphe cichoracearum, Erysiphe polygoni
Gaura	Gaura	Erysiphe polygoni
Geranium	Cranesbill	Erysiphe polygoni, Sphaerotheca fuliginia, Sphaerotheca macularis
Gerbera	Gerbera Daisy	Erysiphe cichoracearum, Oidium begoniae
Gloxinia	Gloxinia	Erysiphe cichoracearum

Plant Genus	Common Name	Powdery Mildew Species
Hebe	Hebe	Erysiphe cichoracearum
Hedera	English Ivy	Erysiphe cichoracearum
Helianthus	Sunflower	Erysiphe cichoracearum, E. cichoracearum var. latispora, E. polygoni
Heliopsis	Orange Sunflower	Erysiphe cichoracearum, E. cumminsiana, E. galeopsidis, Leveillula taurica
Heuchera	Coral Bells	Erysiphe cichoracearum, Sphaerotheca alpine, S. fuliginia, S. macularis, S. mors-uvae
Hibiscus	Hibiscus	Erysiphe cichoracearum, Leveillula taurica
Hypericum	St Johnswort	Erysiphe cichoracearum
Iberis	Candytuft	Erysiphe polygoni
Impatiens	New Guinea Impatiens	Oidium spp.
Lamium	Dead Nettle	Erysiphe cichoracearum, Erysiphe galeopsidis
Lathyrus	Sweet Pea	Erysiphe polygoni
Liatris	Gayflower	Erysiphe cichoracearum
Linaria	Toadflax	Erysiphe cichoracearum
Myosotis	Forget-Me-Not	Erysiphe cichoracearum
Nemophila	Baby Blue Eyes	Erysiphe cichoracearum
Nicotinia	Flowering Tobacco	Erysiphe cichoracearum
Papavar	Poppy	Erysiphe polygoni
Pelargonium	Geranium	Erysiphe communis
Penstemon	Beard Tongue	Erysiphe cichoracearum
Phlox	Phlox	Erysiphe cichoracearum, Sphaerotheca macularis
Polemonium	Jacob's Ladder	Erysiphe cichoracearum
Primula	Primrose	Erysiphe polygoni
Prunella	Self-Heal	Erysiphe cichoracearum, Sphaerotheca fuliginia, S. macularis
Ranunculus	Ranunculus	Erysiphe polygoni, Sphaerotheca macularis
Rosa	Rose	Oidium begoniae, Sphaerotheca fuliginia, S. macularis, S. pannosa
Rosmarinus	Rosemary	Sphaerotheca spp.
Rudbeckia	Gloriosa Daisy	Erysiphe cichoracearum
Salvia	Sage	Erysiphe cichoracearum
Saxifraga	Saxifrage	Sphaerotheca fuliginia, Sphaerotheca macularia
Senecio	Dusty Miller	Erysiphe cichoracearum, E. cumminsiana, Sphaerotheca fuliginia, S. macularis
Solidago	Goldenrod	Erysiphe cichoracearum, Erysiphe communis,Sphaerotheca fuliginia
Stokesia	Stokes Aster	Erysiphe cichoracearum
Verbena	Verbena	Erysiphe cichoracearum
Veronica	Speedwell	Sphaerotheca fuliginia, Sphaerotheca macularis
Viola	Pansy	Sphaerotheca fuliginia, Sphaerotheca maularis, Sphaerotheca violae
Zinnia	Zinnia	Erysiphe cichoracearum

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Education for Horticulture