

Update on Rust Diseases and Their Control

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In the past ten years or so, we have seen many “new” rust pathogens on ornamentals. Since returning to California in 1994, I have seen rust on *Solidago*, aster (originally described in Japan-1898), lantana, *Bellis* (also infects common groundsel throughout California), chrysanthemum (brown rust), *Hypericum*, sunflower, geranium, rose, snapdragon (described first in California in 1895), geranium (described in California and New York in 1967), mint, *Dianthus* and *Heuchera* to name a few.



Figure 1. Rust on *Dianthus*.

Every year, white rust (*Puccinia horiana*) on chrysanthemum is intercepted at ports of entry across the US and once in a while it has been found in production greenhouses, especially in the Northeast and along the West coast. White rust on chrysanthemum was first described in 1895 in Japan and not until 1963 was it found elsewhere in the world (China). It was found in both commercial nurseries and gardens in California in 1991 and eradication steps were taken. Last year it was found in a cut flower nursery in San Diego County where it had also been found in both 2002 and 1998.

In 2001, daylily rust (caused by *Puccinia hemerocallidis*) was found in Florida and by the end of 2003 it was reported in nearly every other state including California. Since that time it has received quite a lot of attention from researchers looking for the best way to control the disease. The difference between effective fungicides for prevention, eradication and their ability to kill rust spores was an important focus of this work. In addition, each year there are studies conducted to determine cultivar resistance to the rust.



Figure 2. Hemerocallis rust.

In 2005, we saw guava rust (*Puccinia psidii*) develop in San Diego County on field-grown myrtle (used for cut foliage) and it has remained a concern every year since. As the name indicates, it was originally found on guava but does attack many other members of the Myrtaceae family. During the same time frame, guava rust also appeared for the first time on some tropical crops in Hawaii. The disease has caused serious losses in the eucalyptus industry in many countries including Brazil. Hawaii has stopped importation of Myrtaceae plants and cut foliage products that are known to host the rust from all sources domestic and foreign in an effort to keep this disease from becoming an even more serious concern in their native forests (*Ohia* in 2005). Most recently, the US government has posted a study performed on the potential hazards and manner of controlling importing guava fruit from outside the US. Unfortunately, guava rust was not even mentioned as a pest of concern.



Figure 3. Myrtle rust.

Gladiolus rust (*Uromyces transversalis*) is also newly reported in the US. This rust was originally described in 1898 and has been listed under federal quarantine with interceptions reported in 2004 (Mexico, 2005 (Mexico, Brazil and Colombia) and 2006 (Mexico and Colombia). Unfortunately, in the spring-summer of 2006, rust was found in a very severe outbreak in very large acreage of Florida gladiolus production. At the same time gladiolus rust was found in a very small commercial cut flower operation and a few backyard gardens in San Diego County but has not been found in the major cut gladiolus producers in California, Michigan or elsewhere in the US. It continues to be under quarantine and transport of gladiolus from Florida to other areas is monitored.



Figure 4. Gladiolus rust.

Some of the most helpful information developed in the past five years was conducted by Mueller, Jeffers and Buck on a variety of rust diseases on ornamentals. They researched the ability of several fungicides to kill rust spores and found that the best products were Daconil Ultrex, Dithane T/O, Heritage and Phyton 27. In direct contrast to their ability to kill spores, these fungicides worked to different degrees when applied to plants (daylily, geranium and sunflower) when used either before or after inoculation. Mueller, Jeffers and Buck. Plant Dis. 89:255-261 and 88:657-661.

Table 1. Effect of fungicides on killing spores of the daylily rust.

Fungicide	% kill
Banner MAXX	83%
Chipco 26019	0
Daconil Ultrex	Almost 100%
Dithane T/O	Almost 100%
Eagle (Systhane)	45%
Heritage	Almost 100%
Phyton 27	Almost 100%
Strike	56%

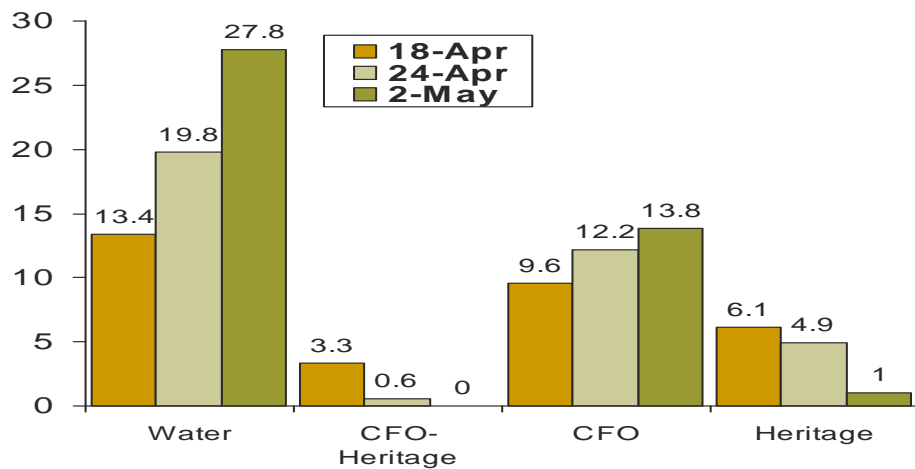
Table 2. Ability of fungicides to prevent or cure rust on daylily, geranium and sunflower. The numbers in parentheses represent the number of days before inoculation (prevent) or after inoculation (cure) that the particular fungicide was applied and controlled the rust.

Fungicide	Daylily	Geranium	Sunflower
Heritage	Prevent(10) Cure (5)	Cure(7)	Prevent (15) Cure(7)
Daconil Ultrex	Prevent(5)	Prevent(15)	Prevent(1) Cure (1)
Systhane	Prevent(5) Cure (3)	Prevent(5) Cure (7)	Prevent(5) Cure (5)
Banner MAXX	Prevent(1) Cure(5)	Cure(5)	Prevent(1) Cure(5)
Strike	Prevent(5) Cure(5)	Prevent(10) Cure(5)	Cure(1)

The longest preventative acting products were Heritage, Daconil Ultrex and Strike. For instance Heritage applied 10 days before the inoculation was effective at stopping daylily rust. In contrast, the best curative products were Heritage, Systhane and Banner MAXX. Heritage was the only product included in the trials that worked well as both a preventative and curative. This may explain why it has worked so well in our trials over the past 10 years when we have tested rust disease control.

Wetting agents improve rust control

We have been testing a number of different wetting agents for their ability to improve disease control. In one trial earlier this year, we tested Crocker's Fish Oil (CFO) with and without Heritage to determine if the combination worked better than either alone. The rust we tested was Bellis rust (*Coleosporium*). We collected plants with rust at a moderate level and started the following treatments: water, CFO (2%), Heritage (1 oz/100 gal) and the combination of the two. The fungicides were applied three times on a weekly interval between 14 and 28 April. The graph below shows the results with the average number of rust pustules per plant on the dates shown.



As you can see the rust continued to develop on the plants sprayed with water up to almost 28 pustules per plant. In contrast CFO alone slowed down development of the rust to only 14 pustules. The Heritage alone was very effective resulting in nearly 100% eradication by the end of the trial. However, the best treatment was the combination of the CFO wetting agent and Heritage. The level of disease was drastically reduced even after a single application and was undetectable at the end of the trial. We have seen a similar result on other rust diseases with other fungicides and wetting agents. It is clear that adding a wetting agent to a rust control program is very effective.

I have summarized most of our rust trials over the past 12-13 years and shown the results in Table 3. We included a variety of different rust diseases including those on *Bellis*, geranium, Hypericum, lantana, rose, snapdragon and *Solidago*. Currently we are trialing more products in a field trial on rose rust and greenhouse trials on daylily rust. If you subscribe to our monthly newsletter – *Chase News* – you will see results of these and other trials in the coming months.

Table 3. Overall efficacy of some fungicides for rust control in trials at Chase Horticultural Research Inc. from 1996 through 2008.

Product	Rust Control
Actinovate	none
Banner MAXX	good to excellent
Camelot	poor to good
Cleary 3336, OHP-6672, Fungo	very good to excellent
Clevis	very good to excellent
Compass O	fair to excellent
Concert	good
Cygnus	none to excellent
Decree	fair to very good
Dithane	very good to excellent
Eagle (Systhane-Hoist)	very good to excellent
Heritage	excellent
Insignia	very good to excellent
Junction	good
Kocide TNO	none
Milstop	very good
Pageant	excellent
Palladium	none
Phyton 27	poor to very good
PlantShield	fair to very good
Protect T & O	very good to excellent
Rubigan	very good
Spectro	very good
Strike	good to excellent
Terraguard	good to excellent
Triact	very good to excellent
Trinity	very good to excellent

Conclusions

We are still relying on protectant products available in the 1970's such as chlorothalonil and mancozeb for prevention of rust and as the work by Mueller et al. shows they remain some of the best products for killing spores and preventing disease. The newer, systemic fungicides like sterol inhibitors (propiconazole, myclobutanil and triadimefon) as well as strobilurins (azoxystrobin, kresoxim methyl, pyraclostrobin and trifloxystrobin) provide some eradicant benefits. Use a 14-21 day interval with protectants like mancozeb when conditions are unfavorable for rust and you are in a preventative mode. If an outbreak occurs, use of sterol inhibitors and strobilurins with a wetting agent will be your most effective means of eradication. Be sure to rotate between classes of fungicides or tank mix a protectant and systemic eradicant to make sure resistance does not develop.

