

Our Favorite Fungus

By Patrick O'Connor

On occasion, almost all iris growers have been visited by our fungus friend, *Puccinia iridis*, or iris rust. At least knowingly, we never invite this guest, but it will quickly bring others of its kind and persist from season to season if accorded hospitable treatment. Once it has a foothold, iris rust will rarely leave on its own volition.

Rust disease on irises is not deadly, but it is ugly, and in severe infestations, it will damage foliage on some varieties enough to retard growth. Infected foliage may collapse and turn yellow prematurely. If you have rust in your garden, you will want to be rid of it, and control is possible with specific and usually manageable steps.

What Is Rust, Exactly?

Many species of rust exist. They are fungi that rely on other organisms for nutrients. Many, including *Puccinia iridis*, are **obligate parasites**, meaning that they require living plant tissue to grow, feed, and reproduce. Iris rust occurs on irises only. Other species of rust are specific to different plants. Daylily rust, for example, is a different species, *Puccinia hemerocallidis*, and it will not infect irises. And so on for innumerable other rusts and different hosts. Total rust species number on the order of 7,000.

In truth, there has not been a great deal of research on iris rust specifically. Rusts that infect valuable food crops, on the other hand, have been much studied. There also has been a significant amount of research on daylily rust, which is a more insidious problem than iris rust. Although rust species' characteristics and life cycle differ in many ways, iris growers attempting to control the problem have no current option but to assume similarities with other rust species in certain respects. That will be the case in this account.

How Does Rust Reproduce and Spread?

Crafting effective countermeasures requires understanding how rust lives, loves, works, and goes about its daily business. Rust spreads from spores that are distributed primarily by the wind. A single **pustule** – just one of the slightly raised, rust-colored dots on a leaf usually surrounded by a yellowed area – may contain 10,000 spores, to say the least, an intimidating number. These spores are called **urediniospores** and are one of five types of spores a rust species can produce. If the pustules are dark or black and appear later in the season, they are a different type called **teliospores**.

This difference is significant because there are two ways that many rust species, including iris rust, reproduce: **asexually** and by **sexual reproduction**. The early urediniospores are involved in asexual reproduction. They are essentially cloned, and the new ones are quickly dispersed to infect more leaves.

In theory, to control rust, we must disrupt both the asexual and sexual reproduction processes. However, it is likely that for most iris growers, the asexual process is by far the most significant. Practically speaking, it may be the only relevant one.

Asexual Reproduction. The rusty-brownish or orange pustules containing the uredinio-

spores first appear in early spring. They erupt, and the wind spreads the spores to other living leaves. Direct leaf-to-leaf contact, insects, or gardeners and their tools may also distribute them. When the spores have arrived on an iris leaf, they are capable of “germinating” and forming a structure that grows into the leaf tissues. Inside, they form a network of rust strands or filaments called **mycelium**, which is the vegetative part of the fungus. The mycelia spread, living off the nutrients in the iris leaf. Under favorable conditions (such as moderate temperatures and ample moisture), mycelia eventually produce other pustules containing more urediniospores which emerge

onto the leaf surface where they become visible. Additional spores are then released to be distributed by the wind and other means, continuing and increasing the outbreak of rust.

The mycelia are not visible. An iris leaf may contain rust mycelia and yet appear rust-free until the new pustules appear and erupt. Thus, a garden may have an infestation without the gardener knowing right away.

Sexual Reproduction.

In rust species, including *Puccinia iridis*, sexual reproduction is more complicated. It involves a cycle that includes an alternate host (a plant species other than an iris) and an additional, specialized type of spore produced later in the year. These dark or black **teliospores** do not appear until fall or winter – if infected foliage remains on the iris.

In irises, the alternate host plant is **nettle**, and in day-lilies, it is *Patrina* species. Common stinging nettle, *Urtica dioica*, is widespread in North America but probably not in urban areas. Rust cannot be spread to irises by sexual reproduction unless there is a nettle population in the vicinity, but if that is the case, nettle needs to be controlled. (Any gardener who insists on growing stinging nettle should at least locate it as far away from their irises as possible.)

How To Disrupt the Life Cycle of Iris Rust

Left alone and once established in a garden, there is a strong chance that iris rust will come back from year to year. That is not always the case because external conditions, such as winter cold and summer heat or the amount of rain, may naturally disrupt its life cycle. In truth, it is not always clear why iris rust comes and goes. It does not seem as resilient as daylily rust, and afflicted gardens can eliminate the problem, save occasional mild outbreaks. Daylily growers seem to struggle on and on.

There are several widely accepted steps to control rust.

Remove Infected Leaves

Once rust has been identified in the garden, promptly remove all infected foliage, including dead or yellowed leaves that may be around the irises. Destroy the leaves or discard them off site, such as in a landfill. Never compost infected foliage, and don't wait to get started.

Cutting and removing foliage with visible urediniospore pustules will undoubtedly cause some spores' release into the

air. However, the presumption is that far more are eliminated in the long run, and the overall result will be a reduction in the spread of infection compared to taking no action. As much care as practical should be taken while removing foliage, and some recommend using a fungicide after foliage removal to prevent or inhibit spore germination.

It is desirable to disinfect one's hands and tools after cutting infected foliage. However, if you deal with an extensive iris planting, such as in public gardens, or use volunteer labor, only so much care in removing infected foliage may be practical. A home gardener presumably could apply more refined and delicate techniques.

Elimination of infected foliage in the spring should prevent the formation of teliospores in the fall or winter. Thus a concern with sexual reproduction of iris rust, with or without nettle, can be rendered moot.

Thorough end-of-season clean-up of iris plantings is an essential step if rust is to be

controlled. The beginning of the iris growth cycle in the fall – when old foliage is shed and new growth begins – is an excellent time to remove unattractive yellow foliage and clean up any garden debris that may harbor rust spores. Even if infected foliage has been removed from the garden as it was found, spores may remain on or around the plants. It is unclear how long and under what conditions spores might survive and remain viable, so removing as much plant debris as possible in the fall is an excellent strategy to break the rust cycle before the following season. Some gardeners have reported that diligent garden clean-up has been sufficient to damp down an outbreak of rust without resorting to chemical treatments.

Prevent Germination Of Rust Spores

Moisture. Rust requires moisture for the “germination” of spores that have arrived on uninfected leaves. A daylily source indicates that if temperatures are ideal, around 72-75 degrees F., a host leaf must remain wet for at least four to six hours for germination to occur.¹ If that applies to iris rust, it explains why outbreaks are noticed most in the early spring. After summer heat arrives, additional infections are seldom seen.

There is no way to eliminate the rain, dew, and humidity that provide the moisture needed for spore germination in early spring. However, knowledgeable people cite overhead watering, especially at night, as a potentially avoidable con-



Iris rust marring a photo of the beautiful 'Fringed Gold' (Don Shepard, 1992)



Iris rust (Puccinia iridis) on Louisiana iris foliage

tributing factor. In a garden situation where drip irrigation is feasible, it is preferable. Overhead watering in the daytime or in the early morning hours, when dew is likely to be present anyway, are other strategies that may minimize outbreaks of iris rust. Since Louisiana irises are water-loving plants, their moisture needs are paramount.

Fungicides. Many fungicides exist, and a few are both accessible and relatively inexpensive. Broadly, there are two types: systemic and contact. The plant absorbs systemic fungicides, and their effect may be both curative and preventive. If curative, the fungicide will attack and hopefully kill the fungus within the plant, and the production of additional spores will cease. On the other hand, a contact fungicide is simply preventive. It will kill spores that the wind has deposited on the leaves, halting germination and the spread of rust due to the particular spores that have arrived or may arrive while the fungicide remains sufficiently potent.

A mix of both systemic and contact products is recommended. Systemic, curative fungicides sound appealing, but they may not work well on established infestations. Systemics work best in the few days following infection. Fungicides are not one hundred percent effective, and it is important to follow product instructions, especially concerning the frequency of application.

The best way to integrate fungicides into a campaign against rust depends on the conditions in each garden. Consider the following:

If there has been a severe infestation in the previous year, spray with a systemic in very early spring before temperatures hit the optimal range for the spread of rust. A good time might be immediately as soon as rapid iris foliage growth begins as winter ends.

Following this, at the first sign of rust, spray with a contact fungicide to attack spreading spores and protect iris leaves from further germination. Then, spray as needed and according to the manufacturer's directions until temperatures rise in summer and conditions conducive to the spread of rust cease.

After fall garden clean-up, spray with a systemic or contact fungicide to inhibit germination of spores that may linger on remaining foliage.

Plan to rotate products over the season to prevent the build-up of resistance to any single fungicide. A few products are suggested below, but iris growers with rust issues should do a bit of research for more complete information. Search on the internet for articles on daylily rust, which has been studied far more than iris rust but seems similar in its behavior.

Other Steps To Control Rust
Grow Resistant Varieties.

If experience shows that a variety is highly susceptible to rust, consider eliminating it from the garden. On the other hand, if a rust-prone cultivar is important, special precautions – such as early use of fungicides – are advisable. The species *I. fulva* and *I. brevicaulis* seem afflicted by rust more than the others, and certainly, one may not want to eliminate those from the garden. The same may be true for some older cultivars that are especially enjoyed or valuable for historical reasons. Older cultivars, nearer to the species in their ancestry, may be more prone to rust. Over the years, rust resistance has probably been a factor in selecting new varieties to register and introduce, so modern cultivars as a group appear more rust-resistant.

Rust-prone irises might be potted and used as sentinel or indicator plants monitored carefully for the first signs of rust in a garden. If infected, relocate the pots away from other irises and consider a more aggressive fungicide regimen. In addition, one might use these susceptible varieties effectively in experiments to test various control techniques.

Plant Spacing. Plants growing vigorously in dense clumps facilitate the spread of spores by direct leaf-to-leaf contact. They will also be slower to dry out from dew, rain, or watering, creating conditions more conducive to spore germination. On the other hand, lush foliage generally means lots of bloom stalks, which we want. This is a balance that the gardener must strike.

Be Careful What You Bring Into The Garden.

Plants that you introduce into your garden may be infected with rust or harbor spores or mycelia, even if invisible. Commercial growers undoubtedly practice good iris hygiene, and the plants they ship will have been disinfected with a wash in a mild bleach solution or the like. That may be sufficient to kill any rogue spores. However, irises from unknown sources or, especially, the wild, should be viewed with caution.

Wild irises often are infected with rust since no one is available to insist on good cultural practices. It is not clear if spores may exist in the soil, but a proper wariness would suggest that bare-root planting is a good idea, so wash any existing soil from the roots. In addition, cut back old foliage to eliminate leaves that may be infected with invisible rust mycelia. Those steps should halt or greatly diminish the transmission of rust.

Limit Nitrogen. Avoiding excessive use of **nitrogen fer-**



A seedling looking good, except for rust.

tilizer is a standard recommendation to control rust, but there is no evidence that nitrogen directly affects the disease. Rust is a fungus without roots and leaves that respond to nitrogen as plants do. Rust obtains nourishment from the iris leaves in which the mycelia live. However, nitrogen might indirectly spread the disease if excessive nitrogen application causes plants to grow rapidly and thickly, creating dense clumps with reduced air circulation and greater direct leaf-on-leaf contact. The best advice is to apply nitrogen at a rate recommended for the good performance of Louisiana irises, and not more or less.

Apply Wood Ashes? A few growers have asserted that the application of wood ashes in containers and beds of irises acts to prevent or cure rust outbreaks. No available written information on rust mentions this treatment. Growers who use wood ashes report no harm when applied in moderation, although ashes are alkaline and might slightly change the soil's pH. Those who use the technique report beneficial results. If wood ashes help control rust, the mechanism by which it works is not known. Possibly ashes create conditions in which spores are less likely to survive in or on the soil over winter. It is also possible that a reduction seen in rust is due to another cause, and the application of ashes is coincidental. The use of wood ashes should be an easy and potentially valuable avenue for experimentation.

Avoid Manure? Manure as a cause of rust outbreaks has been suggested since the early days of SLI. In those times, gardeners used manures more extensively than today. Some early gardens, such as W. B. MacMillan's in Abbeville, LA, often had significant problems with rust. The speculation at the time was that his heavy use of manure was the culprit. However, many iris gardeners using manures have reported no rust outbreak. Possibly, rust spores can be brought into gardens along with manure and associated material, but there is no evidence, as with nitrogen, of a relationship between manure itself and rust. Many growers use commercial products such as Black Kow with no resulting rust problem.

Remaining Questions

Scientists who study fungi – mycologists and phytopathologists – may roll their eyes at this hobbyist's treatment of iris rust. Much more detail about the rust life cycle is known, but additional expert focus specifically on iris rust would be most welcome.

Popular articles on iris rust treatment consist mainly of descriptions of the characteristics of the fungus, the damage that it inflicts on irises, and lists of cultural practices thought to help. Experience shows that rust can be controlled significantly or eliminated if cultural recommendations are implemented.

To some extent, suggested practices may be a case of overkill. Control may be possible with the implementation of less

than the full set of recommendations. Will just meticulous removal of infected foliage do the trick without resorting to fungicides? We just don't know with certainty, and perfect clean-up is hard to achieve.

The wind-blown spread of rust from plant to plant is understood, but the mechanism of transmission from season to season is not entirely clear. Imagine yourself in your iris garden in late winter. That would be in January or early February in the Gulf South. You probably will not have seen rust since the previous year. During the entire growing season beginning in September or so, its ugly face has been absent, and foliage growth is crisp and clean. With the end of winter and the beginning of warmer nights, the spring burst of foliage growth begins. By early March, scapes are visible.

Then early signs of rust appear, starting in a few varieties. Where has it been? Why is it popping out now? Was the foliage already infected with the invisible mycelia from the previous season? Did moderating temperatures jumpstart its production of the rust lesions that erupt onto the leaf surface to become what we recognize as iris rust?

Or, were the plants rust-free at the end of winter, only to be infected by spores that had been lurking on yellowed or decaying plant material left over from the previous season? Or perhaps on the soil surface or even the mulch around the irises?

The exact mechanism of spread may be incompletely understood, but an arsenal of effective techniques to combat rust is available. It would be wise to emphasize good cultural practices so that if fungicides are needed, it is to the minimum extent possible.

Keep in mind that *Puccinia iridis* is endemic to irises and will pop up now and then. So even with your best efforts at control, expect to deal with it from time to time.



A Few Fungicides for Iris Rust

Systemic

BioAdvanced (formerly Bayer) Disease Control for Roses, Flowers and Shrubs. Contains Tebuconazole. Available at stores such as Lowe's and Home Depot.

Contact

Garden Tech Daconil. Contains Chlorothalonil. Available at Lowe's and Walmart.

Bonide Mancozeb. Available at Walmart.

1 Scott Elliott on daylily rust: <https://tinyurl.com/44ae6h8r>

Thanks to Robert Treadway for several of the pictures of rust, each taken in gardens other than his own.