Progress in understanding rapid blight of cool season turf

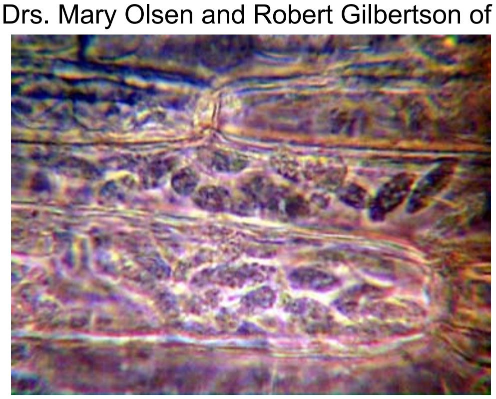
by Larry J. Stowell, Ph.D. and Wendy Gelernter, Ph.D.

Bottom line: Since 1995, when it was discovered in PACE's laboratory to be a new pathogen of cool season turf, the identity of the disease that came to be known as rapid blight was hard to pin down, with some experts identifying it as a primitive chytridiomycete fungus and others as a protozoan. Success was finally achieved in March, 2003, when the laboratories of Dr. Mary Olsen and Dr. Robert Gilbertson confirmed that rapid blight is caused by an obscure microorganism that has features of both fungi and protozoans and is known as *Labyrinthula*. Until the discovery of its role in turf disease, *Labyrinthula* had been most frequently found infecting plants in marine environment such as seagrass, diatoms and algae. Further progress has been made in work by Drs. Bruce Martin, Mary Olsen and Dave Kopec in determing which turfgrass species are susceptible or tolerant to rapid blight infection. Additional field research has confirmed the activity of mancozeb (Fore, Protect) – either alone or in combination with trifloxystrobin (Compass) or pyraclostrobin (Insignia) for preventive control of this disease.

By now, most of you have heard about (or if you are unlucky, experienced) a new disease of cool season turf known as rapid blight. First identified in PACE's lab in 1995 on *Poa annua* green samples, the disease has now been identified on over 100 golf courses in 11 states throughout the Southern tier of the U.S.

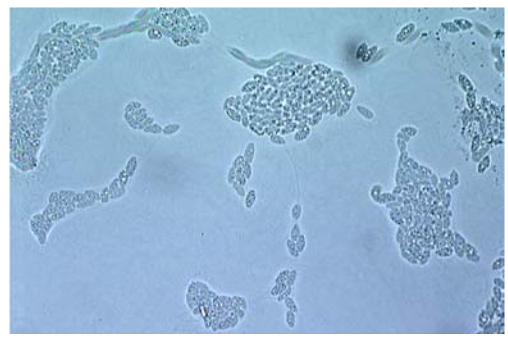
And you thought "chytridiomycete" was hard to pronounce

The football-shaped microbes (seen in this micrograph packed inside a diseased ryegrass leaf) are signs of the disease known as rapid blight, and were recently identified by Drs. Mary Olsen and Robert Gilbertson of the University of Arizona. The disease was originally thought to be a primitive type of fungus known as chytridiomycete, but Olsen and Gilbertson found that it is caused by an even more obscure microbe known as *Labyrinthula.* Despite this new information on its scientific name, we have retained the common name of rapid blight for this turf disease.



Olsen and Gilbertson's discovery is allowing researchers to study the organism growing in plants and also in laboratory Petri dishes as a means of better understanding its biology, growth requirements and control.

The photo to the right, taken in Dr. Olsen's lab, shows the pathogen growing – for the first time -- outside of the plant, on a laboratory Petri dish. The single cells are forming networks, which is characteristic of *Labyrinthula*.



When a scanning electron microscope was used to get a magnified, 3D look at a group of *Labyrinthula* cells inside a ryegrass leaf (photo on left), their football shape was apparent.

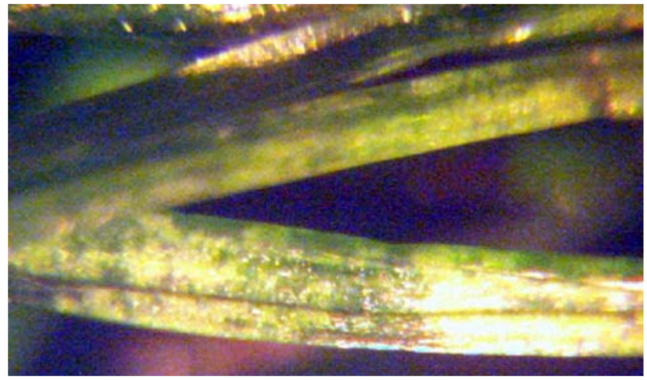
The photo on the right shows an even more magnified scanning micrograph of a single *Labyrinthula* cell. Scanning micrographs courtesy of M. Olsen, University of Arizona.

Until the discovery of *Labyrinthula* on turfgrass, this microbe had primarily been observed in salt water environments -- in sediments in estuaries and other marine environments, or causing disease on marine plants such as eelgrass and other seagrasses. The identification of *Labyrinthula* on turf, which is of course non-aquatic, is a first. This pathogen's ability to survive and cause disease in plants that live in salt water environments is notable, since many (though not all) of rapid blight infestations occur on golf courses with elevated soil salts. Given the likelihood that *Labyrinthula's* natural habitat is salt water, it isn't surprising that it thrives on golf courses where poor quality irrigation water, reclaimed water or salt water intrusion occurs.

Before the discovery of its economic impact on turfgrass, *Labyrinthula* was known primarily for its economic and environmental impact on plants and wildlife in coastal environments. During the 1930s and 1940s, *Labyrinthula* caused "wasting disease" of eelgrass throughout Europe and North America. The healthy, underwater eelgrass bed shown below (photo by the Bamfield Eelgrass Stewardship Project, British Columbia) looks innocuous at best, and troublesome for swimmers and boaters at worst. But it turns out that eelgrass and other seagrasses are beneficial organisms that provide food and shelter for economically important fish such as herring, cod, scallops, oysters, crabs, clams and sea urchins, as well as for waterfowl such as brants, Canada geese and black ducks. The destruction of eelgrass beds during the 1930s and 40s by *Labyrinthula* led to severe losses in the shellfish and fishing industries in the U.S. and Europe.

Labyrinthula causes the death of seagrasses by rapidly reducing their ability to conduct photosynthesis. The lesions it forms on seagrass leaves are very similar to those we see on turfgrass (see photo at top right). It is likely that the mode of action in seagrass and turfgrass is very similar, despite the very different biology of these two plants.

Perennial ryegrass leaf blades infected with rapid blight. Note the darkened, water-soaked appearance of the diseased lesions.



Rapid blight symptoms

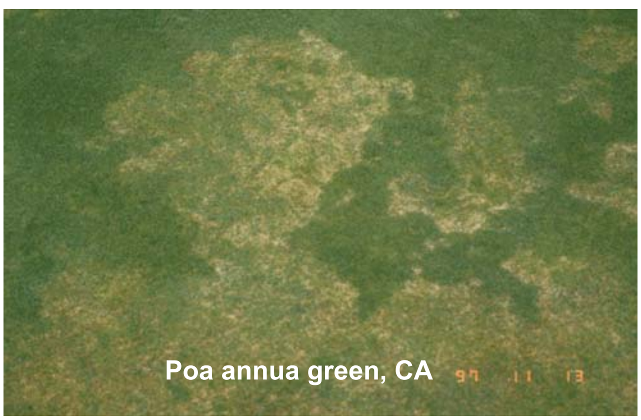
Rapid blight (*Labyrinthula*) can cause serious damage to *Poa annua, Poa trivialis* and perennial ryegrass, and can cause moderate damage to bentgrass as well. Rapid blight has been diagnosed from greens, tees, fairways and roughs. The photos below tell the story better than any words can.

***Poa triv* overseeded green, SC**
Photo courtesy of B. Martin, Clemson Univ.

rye/*Poa triv* overseeded green, AZ


ryegrass overseeded tee, AZ


A4 bentgrass green, CA


Poa annua green, CA


Bentgrass root, CA

Host range

Turfgrass variety trials have been conducted under the auspices of Clemson University (Dr. Bruce Martin) and the University of Arizona (Drs. Mary Olsen and Dave Kopec). The goal is to find which varieties are tolerant and which are susceptible to rapid blight. A summary of the work completed to date appears in the table below. We are still awaiting results on additional varieties including redtop, colonial and velvet bentgrasses, tufted hairgrass and additional varieties of slender creeping fescues and hard fescues.

Tolerant to Rapid Blight	Susceptible to Rapid Blight
Bermudagrass	Poa annua
Slender creeping red fescue*	Poa trivialis
Chewing's fescue*	Perennial ryegrass
Crested dogtail	Intermediate ryegrass
Alkaligrass**	Creeping bentgrass

*fescues exhibited slow germination and growth during fall overseeding weather. If adopted for use in overseeding programs, mixtures with faster growing "helper" varieties may be necessary.
**poor wear tolerance exhibited in AZ trials

Variety trials at Estrella Mountain Ranch, AZ. (Mick Twito, superintendent, Dr. Dave Kopec, researcher) tested 15 alternative overseeding varieties. Of these, slender creeping red fescues (white arrows) appeared to be most tolerant to rapid blight.

Management

As reported earlier, only three fungicidal materials appear to be effective against rapid blight (see Table on page 4). This has been confirmed in several tests conducted at Clemson University (B. Martin) and University of Arizona (M. Olsen).

Treatments work best when applied preventively (before significant damage from disease occurs) and when applied at relatively low volumes (2 gallons/1000 sq ft is optimal). Curative applications (made once the disease has already caused significant damage) are less effective, but can stop the infestation from spreading further. The product labels for both Compass and Insignia have recently been amended to include rates and applications instructions that are specifically for rapid blight, which is welcome progress.

Products tested for control of rapid blight

Effective against rapid blight
Compass (trifloxystrobin)
Fore, Protect (mancozeb)
Insignia (pyraclostrobin)*
Not effective against rapid blight
Aliette Signature (fosetyl-aluminum)
Aqueduct (non-ionic surfactant)
Banol (propamocarb)
BAS 505 (dimoxystrobin)
Chipco 26019 (iprodione)
Daconil (chlorothalonil)
Heritage (azoxystrobin)
Koban (etridiazole)
Subdue Maxx (mefonoxam)

*EPA registration expected Fall, 2003

Some other management tools that can help minimize damage from rapid blight include:

Monitor weather: the frequent appearance of this disease during the fall, winter and spring months indicates that cooler temperatures and/or higher humidities may enhance disease development. In non-overseeded situations, turf should be closely monitored for symptoms during this time period. Courses with a history of rapid blight have been initiating preventive applications when the fall weather gets cool and/or moist. But beware – this disease occasionally strikes even in the heat of the summer, especially if soil salinity levels are high. Don't ignore what you think might be rapid blight just because you see it in the summer. In overseeded situations, the first few weeks after germination of the overseeded turf (usually in September or October), are usually the most critical. If the disease has caused problems on your overseed in the past, preventive applications at overseeding, and/or as soon after overseeding as sprayers can be used, should help keep the disease at bay. A vigilant monitoring for symptoms during this critical time is important.

Cultural practices: disease incidence and severity appear to be linked to practices that are abrasive or disruptive to turf foliage such as aeration, sand top-dressing, overseeding and mowing. Little nicks in the turf cuticle from sand and aerifiers may give disease organisms an easier entryway, and the increased use of heavy equipment may help spread the pathogen from one location to the next. Avoid aeration or sand top-dressing if the turf shows any signs of stress or disease symptoms.

High soil salts: Many (though not all) of the affected golf courses battle high soil salts, either due to lack of leaching rainfalls (in the southwestern states), the use of low quality reclaimed or well water or salt intrusion. To minimize the threat of rapid blight, keep soil salts below 3.0 dS/m via regular salinity monitoring (see PACE Reference 9:3) and leaching programs.

The joys of collaboration

Hunting down the identity of the rapid blight organism has been an important effort that will lay the basis for better understanding and management of this important turf disease. Many researchers have been involved, and all have freely shared their data and their ideas in an effort to provide answers as soon as possible. We want to take this opportunity to thank them, and to acknowledge their contributions.

Dr. Steve Alderman, USDA, Corvallis, OR
Dr. Leah Brilman, Seed Research of Oregon
Dr. Robert Gilbertson, University of Arizona
Dr. Dave Kopec, University of Arizona
Dr. Bruce Martin, Clemson University
Dr. Mary Olsen, University of Arizona
Dr. Frank Wong, University of California, Riverside

Despite everyone's good will though, the progress that we have made so far would not have occurred without money. About two years ago, PACE began a fund-raising campaign in support of Dr. Bruce Martin's research program at Clemson University. We want to thank the superintendents and golf clubs – members of the previously named "Chytridiomycete Working Group" (and now the "Rapid Blight Working Group") – who provided this critical support. The USGA has also played an important role in their further funding of Dr. Martin's program. We will soon be soliciting further funds to support Dr. Mary Olsen's program at the University of Arizona, where she is continuing her work on the biology and management of rapid blight. A lot of progress has been made in the last 18 months, but more questions remain to be answered including:

- How does the chemical composition of soil and irrigation water affect the incidence of rapid blight? Are there specific compounds and/or elements that encourage its growth, and can they be managed to decrease the threat of this disease?
- How does weather affect the incidence of rapid blight? Can some type of simple warning system, based on air temperatures, be developed that will trigger intensive scouting and/or preventive cultural and chemical practices?
- Are there other products or practices than can help prevent and/or cure rapid blight? There is concern that continued reliance on strobilurin products such as Compass and Insignia will eventually result in development of rapid blight resistance, unless fungicides with alternative modes of action are incorporated into the management program.