# A New Disease of Annual Bluegrass, Ryegrass and *Poa trivialis*

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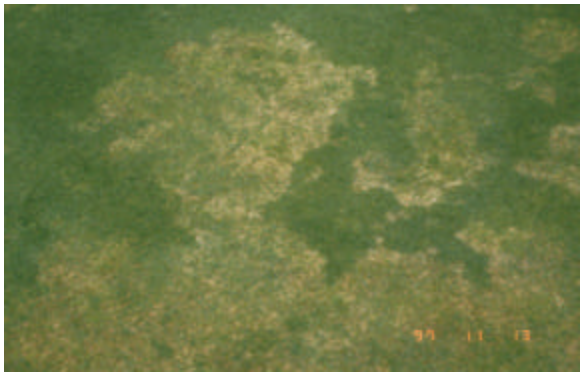
**Bottom line: A new disease of cool season turf was first diagnosed in California, in 1995 from *Poa annua* greens. Since that time, the disease has been observed in 7 different states, and in addition to *Poa annua*, it has caused serious damage to *Poa trivialis* and *Lolium perenne* (perennial ryegrass) used to overseed greens, tees, fairways and roughs. The disease, which is caused by an unusual, single-celled organism that grows inside the leaf cells of turf plants, has tentatively been identified as a chytridiomycete fungus. The frequency with which this disease occurs seems to have escalated in the past few years, causing severe yellowing and death of acres of overseeded turf, and increasingly severe damage to *Poa annua* greens. Because this disease has not been studied in the past, it's management is an unsolved question, although the fungicide mancozeb appears to have at least some ability to prevent widespread damage. And preliminary data from Clemson University suggests that products such as trifloxystrobin (Compass) and the yet to be registered product pyraclostrobin (Insignia) can actually control the disease curatively. A more comprehensive management program will be developed during the next year, based on a collaboration between Clemson University and the PACE Turfgrass Research Institute.**

**Figure 1.** Initial symptoms of the chytrid disease on a *Poa annua* green (California)

**Figure 2.** Advanced symptoms on a *Poa annua* green (California)



Luckily, identification of a new disease of turf (or of any crop for that matter) is a rare event. But since 1995, we have been seeing more and more damage to *Poa annua* greens and overseeded *Poa trivialis* and perennial ryegrass from a pathogen that appears in no textbooks, no extension publications, and no research papers. Our work with this organism indicates that it is a fungus that has not ever been described as a serious turf disease, but research is still very early in development. The organism has not been conclusively characterized and identified, it has not been successfully cultured in the laboratory, and its management and control is still an open question. But recently intensified research efforts should help bring this new threat to cool season turf into better focus within the next year. In this issue of *PACE Insights,* we will report what we have learned so far about the disease that we are tentatively calling a **chytridiomycete fungus**, as well as what kind of progress we expect to be making in the near future.

## The symptoms

Irregular shaped patches of chlorotic (yellowing) or darkened turf can appear rapidly, seeming to pop up almost overnight (Figures 1-3). Upon closer examination, the discolored turf foliage looks water soaked (Figure 4), and the plants are reduced in size. Eventually, the turf can be completely killed (Figure 5). The most susceptible turf types appear to be *Poa* (both *Poa annua* and *Poa trivialis*) and perennial ryegrass, but further host range testing is ongoing (see "Host Range" below).

**Figure 3.** Symptoms of chytrid infection on an overseeded bermudagrass green (Brightstar SLT perennial ryegrass planted at 30 lb/1000 sq ft plus Winter Plex *Poa trivialis* at 8 lb/1000 sq ft). (Arizona)

When diseased turf tissues are examined microscopically, we see hundreds of oval to football-

shaped objects (resting structures) that are living inside the cells of the damaged plant (Figures 6 and 7). When the infection is severe, there can be many of these resting structures inside each plant cell. Unlike most other turf diseases, we do not see cottony white mycelium or fungal filaments of any kind associated with the disease.

**Figure 4**. Infected foliage appears watersoaked (from rough height perennial ryegrass)

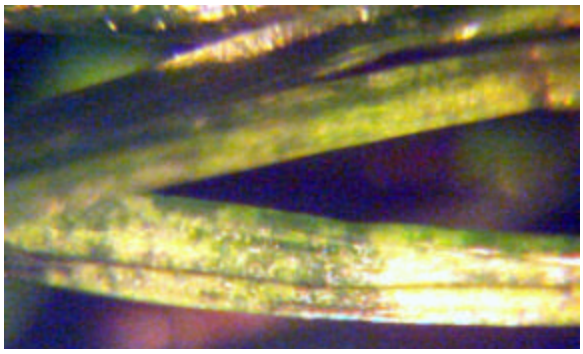


**Figure 5.** *Poa annua* sample plug illustrating the advanced stages of the disease.

**Tentative diagnosis: chytridiomycete infection**

Based on the features described above, we have tentatively identified the disease organism as an uncharacterized species of the **chytridiomycete** fungal group. Although chytridiomycete infections are rare on turfgrass and none have been known to inflict severe damage, these fungi are quite common in nature, with about 1,000 different species identified. Chytrids occur almost everywhere -- on plants and animals (chytrid fungi are believed to be responsible for the worldwide reduction in frog popualtions) as well as in soil and water.

Despite their widespread distribution, chytrids are rarely noticed. They usually don't produce structures that can be seen with the naked eye, such as the cottony white mycelia of *Pythium*, the mushrooms of fairy ring, or the black acervuli (pustules) produced by anthracnose. Chytrids are small, innocuous and difficult to detect unless you have a compound microscope available.

**Figure 6.** Chytrid resting structures inside *Poa annua* leaf cells. The resting structures vary in size, from 12 to 25 microns in length (that's equivalent to 1/2000 - 1/1000 of an inch in length) by 4 to 8 microns in width.

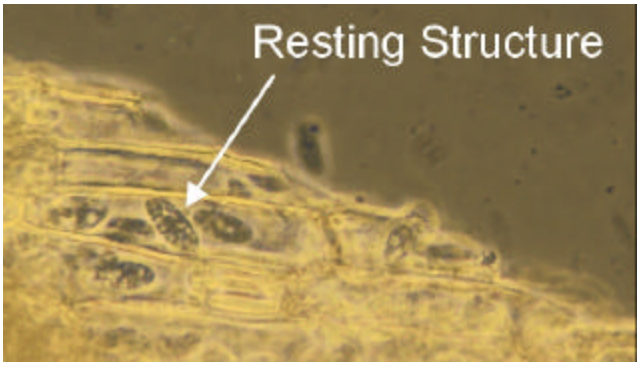
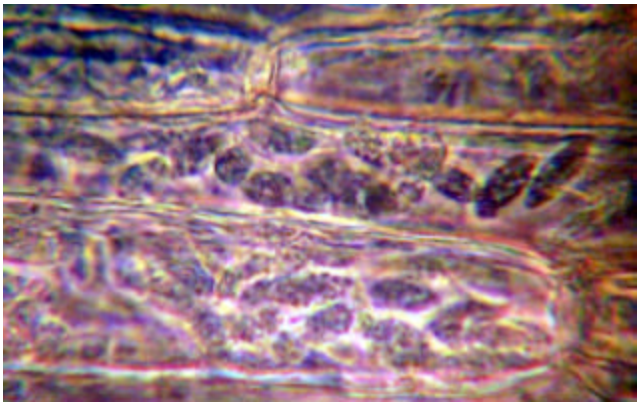



**Figure 7.** Chytridiomycete resting structures inside the cells of perennial ryegrass.



Some general features of chytrid fungi include:

- The reproductive cells, which are known as **zoospores**, can swim very much in the same way as the sperm of mammals -- by using hair-like appendages known as flagella.
- Many chytrids are composed of only a single cell (this is the case for this turf disease), but some can produce a mycelium much like other fungi.
- Of over 1,000 chytrids known, few have any noticeable impact on humans. Exceptions include diseases of potatoes (potato wart caused by *Synchytrium endoboticum*), corn (*Physoderma* brown spot of corn), and cabbage (*Olpidium brassicae*) as well as of algae.
- A chytrid disease of turf known as *Physoderma* leaf spot and leaf streak has been described in the past (Smiley et. al., 1992), but the symptoms are quite different from those we see, and it is not known to cause serious damage to turf. Other chytrid fungi known to attack *Poa* include *Physoderma alpina*, *P. gerhardii*, and *Synchytrium graminicola*. However, the fungal anatomy and the

symptoms caused do not match those of this new, unidentified chytrid.

More taxonomic work on the new disease is ongoing; there is some chance that the organism will turn out to be something other than a chytridiomycete fungus. But until we know more, for the sake of convenience, we will refer to this organism as "the chytrid".

## Poa annua greens: timing of infection

On *Poa annua* greens, the chytrid has been diagnosed primarily from California, with a few cases from Nevada and Arizona. The chytrid appears to attack *Poa annua* greens at all times of year, but the greatest number of diagnoses have occurred during the months of October, November and December (Figure 8).

## Overseeded turf: timing of infection

The most dramatic damage in recent years has been observed on bermudagrass greens, tees, fairways, and roughs that have been overseeded with ryegrass or *Poa trivialis* (Figures 3 and 9). In some locations, the disease can result in greater than 80% loss of the overseeded turf, causing some superintendents to consider a switch to more tolerant turf types, if they even exist (see "Host Range" below). The disease frequently shows up in late October or November, immediately after the first mow, but can appear continuously from November through May. Chytrid infection does not appear to be prevented by the use of seed treated with the fungicide mefonoxam (Apron).

## Host range

PACE's diagnostic work has indicated that *Poa annua, Poa trivialis* and perennial ryegrass are susceptible to the chytrid, and that bermudagrass appears to be unaffected by the disease. Preliminary host range data from replicated field trials conducted by Dr. Bruce Martin of Clemson University in South Carolina has confirmed the susceptibility of *Poa trivialis*. He has also (unfortunately) discovered that some bentgrass varieties **may** be susceptible. The good news is that so far, Dawson slender creeping bentgrass and Chewing's fescue are disease free. It's important to remember, though, that since Dr. Martin's studies will not be completed until later this winter, we shouldn't draw any more concrete conclusions about host range until then. We will keep you posted.

## Factors that enhance disease

Some factors that may be responsible for increased incidence of the chytrid disease include:

- 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.
- Fewer fungicide applications: Once there are no longer threats of summertime diseases such as summer patch and anthracnose on *Poa* greens, fungicide applications are typically reduced. Similarly, fungicides are seldom applied prior to overseeding bermudagrass. These "gaps" in turf foliage protection during the fall and winter months may be the opening the chytrid is waiting for.
- High soil salts: Many (though not all) of the affected golf courses battle high soil salts, either

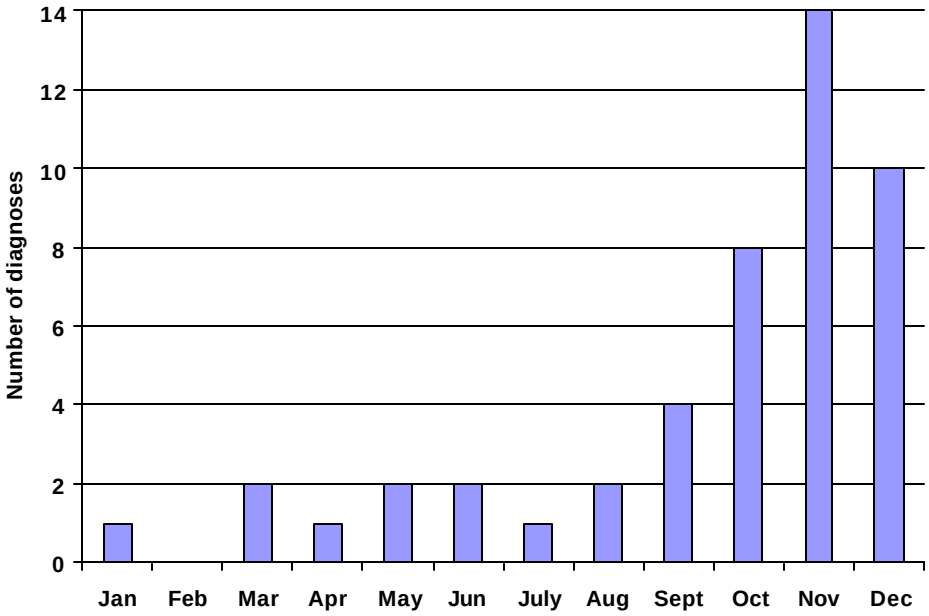



**Figure 8.** Timing of chytrid attack on *Poa annua* greens, based on samples received at PACE, 1995 - 2001. The majority (68%) of chytrid infections on *Poa annua* greens occurs during the months of October, November and December, though the disease has attacked with lesser frequency in all months except February.

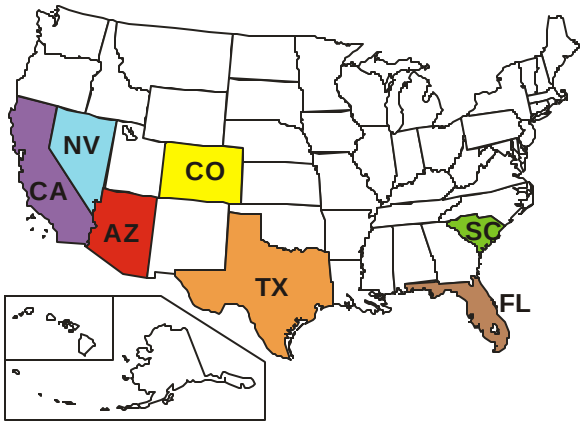
due to lack of leaching rainfalls (in the southwestern states) and/or the use of low quality reclaimed or well water.

- 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. However, the occasional occurrence of the disease on *Poa* greens during the summer (Figure 8) and on overseeded turf in the Desert states and southern states in the relatively warm months of April and May indicates that cool weather is not the most important trigger for this disease.

**Figure 9**. Overseeded tee (ryegrass/*Poa trivialis* mix) with severe symptoms of chytrid infection (Arizona).

## Geographic distribution of the disease

**Figure 10.** Geographic distribution of the new chytrid disease on turfgrass.




Since 1995, PACE has diagnosed chytridiomycete infections at over 60 different golf courses in 7 states (Fig. 10). The majority of *Poa annua* greens infections occur in California, though some isolated occurrences have been documented from Arizona and Nevada. The majority of infections in states other than California occur on *Poa trivialis* or perennial ryegrass on overseeded bermuda greens, tees, fairways or roughs.

We expect that the disease is present in several other states but may have been mis-diagnosed as Pythium or some other related disease.

## Management

In the early phases of our work on this disease, we have focused on the fungicide mancozeb (Fore, Dithane, Mancozeb, Protect, Pentathlon) because it is effective in killing zoospores of other plant pathogens. Courses with a persistent history of the disease that have treated with mancozeb preventively (before the disease symptoms appear) seem to be able to keep the chytrid at bay. But the product does not appear to be very effective at controlling symptoms curatively (e.g. after the disease symptoms have appeared). Until recently, the possibility of curative control didn't exist, but preliminary results from Dr. Martin's South Carolina field trials are giving us some hope. He has reported that applications of trifloxystrobin (Compass) or pyraclostrobin (Insignia: not currently registered) appear to clear up symptoms of the chytrid disease on overseeded *Poa trivialis*. Interestingly, azoxystrobin (Heritage), which is a related product, does not appear to control the chytrid.

We expect to receive more valuable information from Dr. Martin's host range and fungicide trials over the next several months; this, along with our prior experience with the chytrid, will form the basis for development of a comprehensive management program. Until then, the preliminary data indicates that the following practices may help alleviate symptoms caused by the chytrid -- at least in some situations:

- **Preventive** application of mancozeb (Pythium rate) alone or in combination with trifloxystrobin (Fusarium patch rate) may prevent development of the chytrid disease, as well as of either Pythium or Fusarium patch.
- **Curative** application of a combination of mancozeb plus trifloxystrobin (at rates above) may stop further development of symptoms, as well as controlling Pythium or Fusarium patch.
- Keep soil salts below 3.0 dS/m via regular salinity monitoring and leaching programs. The presence of the chytrid disease seems to be strongly linked to the build-up of soil salts.
- Avoid aeration or sand top-dressing if the turf shows any signs of stress or disease symptoms. Activities that abrade or damage the turf appear to increase the severity and spread of the disease.

## References

Smiley, R.W., Dernoeden, P.H. and B. B. Clarke. 1992. Compendium of turfgrass diseases. APS Press, St. Paul MN.