Pink Snow Mold Research In Wisconsin!

By Yolibeth Rangel and Dr. Geunhwa Jung, *Department of Plant Pathology, University of Wisconsin-Madison*

This month, continuing with the introduction of researchers that work in Dr. Geunhwa Jung's lab, Mrs. Yolibeth Rangel will talk about her research with pink snow mold.

I came to the United States for the first time during August of 2000. I was born and raised in Venezuela, where I obtained my undergraduate degree in Agronomy Engineering and then continued on for my Masters in Agronomy with a major in Plant Pathology. I knew nothing about golf, not even about turfgrass, until I began to work in Dr. Jung's lab. My prior work was with diseases in sorghum and rice, which are also grasses, but very different from turf. During these past two years of working with turfgrasses, the diversity and beauty of this crop have amazed me. I cannot imagine how the gardens would be without at least a little space cover by lawn or how any "outdoor architecture" might exclude turfgrass.

Since I am a phytopathologist, the first thing that came to my attention was diseases of turfgrass. I started to work in this lab first with *Typhula* spp and then with *Microdochium nivale*, both fungal pathogens causing the popular snow mold diseases. The most interesting thing about these pathogens is the fact that they affect grasses under such a harsh condition, something that one who does not live in temperate regions (I came from a tropical country and had not really experienced snow) can barely imagine. Working with this kind of microorganisms has allowed me to gain new knowledge that I did not know before. So I am glad to have this opportunity to write for this magazine and share a bit about my research and what I have learned.

Most of you have seen pink snow mold growing in your own lawn. It is a common disease in northern regions of the United States and Europe and is the most important disease of turfgrasses after *Typhula* snow molds. Its causal agent, the fungus *Microdochium nivale*, can affect virtually all grass species and can cause symptoms in turf twice a year, during spring and during fall. During the latter, the symptoms appear distinct from pink patches and the disease is called *Fusarium* patch. It is somewhat confusing that any of these names correctly describe the disease, however they are all appropriate and originated because of varying symptoms. The first major confusion is that the pink color appears only under certain conditions. If there is snow cover, the patches may appear whitish-gray or reddish-brown. However, without snow cover the patches can be seen as reddish-brown. Secondly, the disease is not confined to snow-covered turf, and often occurs during wet and cool fall seasons. Thirdly, the fungal species does not belong to the *Fusarium* genera (the name *Fusarium nivale* was reassigned to *Gerlachia* and then to *Microdochium*). So, do not be fooled by the meaning of the name if you try to determine what those patches on your turf are. Whatever the disease is called, it is likely you could have pink snow mold on your turf if extended cool and wet weather occurs in your area, even though the patches are not pink.

What has happened with snow molds this year? Did you notice any difference? As my lab mate, Elizabeth Scheef pointed out in the last issue of the *Grass Roots*, many golf courses did not show any symptoms of *Typhula* snow mold. However, during her trips throughout Wisconsin collecting snow mold samples over the last two months, she did observe many pink patches in the majority of the golf courses she visited. As explained above, pink snow mold is not limited to regions covered with snow, which differs from *Typhula* snow mold caused by *Typhula* spp. that does require a lengthy snow cover. Pink snow mold is a problem in any area with cool and wet weather in both spring and fall. In

addition, alternate thawing and snow cover, repeated frosts, and/or cold fogs are very favorable for the development of the disease. You may have noticed these types of weather over the past winter, which although unfavorable for *Typhula*, are terrific for pink snow mold.

Pink snow mold, like many other diseases of turfgrasses, is managed almost completely by the use of fungicides. However the fungicides used to control pink snow mold often differ from those effective against *Typhula*, which means that in some cases (depending on the fungicide type) a mix of different products needs to be applied for the control of both. Some cultural practices, such as balanced fertilization, are also useful for reducing the damage of the snow molds. However, one of the best options for an integrated management of not only pink snow mold, but also other diseases, is the utilization of resistant cultivars. Yet, these sources of resistance are not easy to be found or to be incorporated in breeding programs. Resistance to snow mold in turf has not been investigated at all. That is why one of our main research goals as scientists in the Wisconsin Turfgrass Research Program is to develop new turf cultivars resistant or tolerant to snow mold pathogens, which are major problems in the Midwest. However, to achieve that goal, we must go through several time consuming steps, something that the team of scientists led by Dr. Jung has already begun.

Many aspects of *M. nivale* have been investigated so far. In general, the factors affecting development of the disease, such as the source of inoculum, temperature, moisture, snow cover, soil pH and plant nutrition, have been described. However, the diversity of the fungus among the different environmental conditions in many northern areas, as well as in different plant genotypes, remains to be investigated in turfgrasses. The majority of investigations of the genetic variability of *M. nivale* has been done in wheat, where two different varieties of the fungus have been described: *M. nivale* var. *nivale* and var. *majus*. While searching the literature to determine if these varieties occur on turf, I found only one investigation, which was done in Canada. The Canadian researchers concluded that there is no *M. nivale* var. *majus* in turfgrass. However, the area they sampled was limited and possibly quite homogeneous. But what happens here in Wisconsin where over 500 golf courses are found, where environmental conditions and cultural management of turf varies from south to north and from west to east, and where many different species and cultivars of turf are used? It is known to scientists working in plant pathology that environmental conditions, plant genotypes and human beings are responsible for the change of microbial populations. These three cause pressure on particular pathogen species or isolates which are naturally selected to survive under the specific conditions created by those factors. This is exactly what happens when you apply a very effective fungicide repeatedly that controls most of the fungal population, yet a few survive because they were genetically resistant to the product. After awhile, the surviving individual dramatically grows in number and you see your plants infected again by the disease even though you apply the higher doses of the fungicide.

In the case of pink snow mold, evidence of differential host preference between var. *nivale* and *majus* was reported in wheat, rye and oat, where for example var. *majus* hardly caused disease on rye while var. *nivale* caused many symptoms. So, if that is happening in those grasses, how about turfgrass? We all know that turf in a golf course is composed of different turfgrass species or different cultivars of a same species. Can the genetic diversity of turf within and among the golf courses generate a selection pressure on the fungus? Moreover, if that is true, how does it affect the management of the disease?

With those questions in mind, we began a project designed to achieve the following objectives:

1. To understand the genetic diversity of the *M. nivale* population occurring on turfgrasses in Wisconsin.
2. To identify the varieties of *M. nivale* that might be present in turfgrass in Wisconsin.

To accomplish the above goals, we collected samples of pink snow mold from 100 golf courses all around Wisconsin during the spring of 2001. This work was done at the same time when we collected *Typhula* snow molds. As Elizabeth explained in her last Grass Roots article, the golf courses visited represent different temperature and snow cover duration zones in Wisconsin. At each golf course, we collected one to two pink snow mold samples from each of four randomly selected fairways. Then all samples were processed in our lab. For each sample, two isolates, originating from one single spore each, were selected for our studies. After the fungal isolates have grown, we extract the DNA from them and, using a molecular technique, we examine the population diversity of the fungus. This is similar to surveying a group of people from a specific area (say a county) to determine how diverse the human population is in terms of, say, a blood type.

Why is this information so important or useful for you? If you think about the blood type, it can tell you about how many people with each of blood types and how hard to find a specific type. This allows the people working in hospitals in that county to plan a strategy for collecting and storing blood types for an emergency. In our case, knowing how diverse the fungus *M. nivale* is and then knowing how its diversity influences the management of the disease, will allow us to develop a more effective strategy for control of pink snow mold. It could be, for example, that the fungal isolates on one course are genetically distinct from an isolate on another course and that the efficacy of a specific fungicide, therefore, differs on the two courses. Also, for researchers, it is useful to know how different isolates of the fungus specifically affect the various species/cultivars of turfgrass. This will permit us to make further steps in developing turfgrass cultivars resistant to pink snow mold. In conclusion "you need to know the enemy if you want to win the war."

So far, the analysis we have made of approximately 100 pink snow mold isolates has shown the presence of only *M. nivale* var. *nivale*. Yet, we are going to analyze more samples and continue other experiments to obtain a conclusive, comprehensive picture of the population structure of this fungus. I hope this study, as well as all the studies that are being conducted in our lab, will help design better management alternatives that will reduce fungicide applications, environment contamination, and one of your main headaches, snow mold diseases.