Is *Pythium* really a fungus?

by Dr. Eric B. Nelson

Species of *Pythium* have always been known as some what unusual organisms. Not only are they pathogens of plants, but they are major pathogens of fish and horses as well. Ecologically, they don't quite fit in with other well-known fungal pathogens, and morphologically, genetically, and physiologically, they are quite different from other fungi. As a result, there has been much debate over the years on the precise taxonomic placement of *Pythium* species.

Discovered in 1823

Certainly these organisms look like fungi and behave pretty much like fungi. After all, they have been studied by mycologists for over a century. Yet confusion over this organism has existed from the beginning. *Pythium* was first discovered in 1823 by Nees, but the official date for the establishment of *Pythium* as an official genus was not until 1858 by Pringsheim. As our knowledge of *Pythium* species has grown, it has become apparent that there are many significant peculiarities, particularly with differences in morphology, physiology, genetics, and ecology of *Pythium* species as compared with the other so-called higher fungi such as the ascomycetes (e.g. Pyrenophora "Leaf Spot") and basidiomycetes (e.g. Rhizoctonia " Brown Patch").

Some of these differences with other pathogens are apparent to the turfgrass manager. For example, *Pythium* diseases are controlled only by a particular set of fungicides that work only on this group of organisms, and not on other fungi. Furthermore, *Pythium* species produce swimming spores and spread with water movement; no other group of fungi does this. *Pythium* species cause diseases largely under excessively-wet to water-logged conditions. Few other diseases are problems under these excessively-wet conditions.

Other differences, however, are not so apparent to the turfgrass manager, but are quite obvious to the mycologist or the plant pathologist. These include things such as the chemical composition of *Pythium* cells, the type of propulsion system on the swimming zoospores, and some specific aspects of their reproductive genetics. All of these are quite different from characters found in other fungi.

DNA studies are revealing

Current studies on the phylogeny (i.e. the evolutionary history or relatedness among organisms) of *Pythium* species have revealed some interesting relationships to organisms other than fungi. For example, by comparing the DNA of *Pythium* species with that of higher fungi and some of the green and yellow-green algae, it was discovered that *Pythium* species are more closely related to the algae than they are to the higher fungi. There is now a large body of evidence to support this relationship. As a result, the genus *Pythium* has been moved from the fungal kingdom, Mycetae, and placed into the kingdom Protoctista (See Table 1 above.).

Still other studies have compared the DNA from plants and *Pythium* species and have found striking similarities. In general, it appears that organisms containing certain types of chlorophyll, the main photosynthetic pigment in plants and green algae, are more closely related to *Pythium* than other fungi. This is an interesting fact, since plant pathologists have known for a long time that oospores of *Pythium* and other

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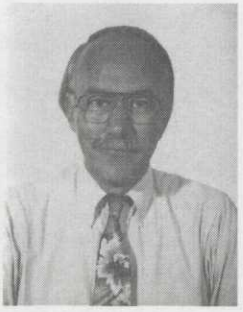
Table 1
Classification of pythium species

Present Scheme	**Classification**	Former Scheme
Eukaryotae	**Superkingdom**	Eukaryonta
Protoctista	**Kingdom**	Mycetae
Oomycota	**Phylum/Division**	Mastigomycotina
Peronosporomycetidae	**Class**	Oomycetes
Pythiales	**Order**	Peronosporales
Pythiaceae	**Family**	Pythiaceae
Pythium	**Genus**	*Pythium*
aphanidermatum	**Species**	*aphanidermatum*

The dog days of August

Seeing grubs and Pythium in a new light

by Juergen Haber



As the dog days of August come upon us we have to worry about a totally different animal: the grub. But now there are more weapons in the arsenal with the completion of an historic first phase study led by Dr. Michael Villani, associate professor, soil insect ecology, New York State Agricultureal Experiment Station, Cornell University.

This second large contribution by Dr. Villani to Turf Grass Trends, (Effective management of Japanese beetles, July 1992), is the first large-scale survey of grub populations in lawns. To understand the scope of the survey one must be told that the researchers took more than 3,000, four-inch round samples.

Field Editor Christopher Sann follows up Dr. Villani's story by telling us how grubs might be less of a problem by increased use of integrated pest management.

Finally, we follow up Sann's story with news brief that bring more bad news for traditional turf managers: pesticides may be curtailed even more.

And speaking of follow-ups, Science Advisor Dr. Eric B. Nelson finishes last month's discussion of Pythium in this issue. The question of whether Pythium is a fungus bears directly on the way turf managers should treat diseases resulting from Pythium infections.

Finally, we have a correction to make: on page 5, lower right, of the July issue, we ran the wrong photograph. It should have been the following:

Photo provided by Dr. Eric B. Nelson, Cornell University

Symptoms of Pythium snow rot on a golf course fairway.

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closely related genera of plant pathogens, require certain wavelengths of light for their spores to germinate optimally.

How does the naming change affect *Pythium* diseases of turfgrasses?

Conventional wisdom and recent experiences with other misidentified pathogens like *Magnaporthae* (Summer Patch) would say that all the *Pythium* species are not really all that different from other fungi or that the *Pythium* species are really just another as yet to be identified "new" branch of the fungal world, waiting to be discovered.

In fact, *Pythium* species are different from the other fungal pathogens. They are as different from these fungal pathogens as fungal pathogens are different from insects. This means that *Pythium* species should be placed into a separate pest category when considering overall control strategies. The control of *Pythium* diseases requires measures unique to this new category, with little or no overlapping strategies with the control of fungal diseases of turf. Interestingly, some of the fungicides that are used for algae control, in particular mancozeb, are also effective *Pythium* fungicides. Perhaps we can learn something about the control of *Pythium* diseases by learning something about the biology and management of algae, and vice versa.

How did *Pythium* evolve?

It is intriguing to note that a number of algal species are parasitic on plants, although none have yet been described on turfgrasses. The most interesting thing about these parasitic algae is that they infect plants by means of zoospores and prolonged culture of these organisms in the laboratory causes them to lose their chlorophyll pigments. Upon losing their pigment, they take on a fungal appearance which very closely resembles that of *Pythium*. Perhaps through evolution or environmentally, *Pythium* was an alga that became a fungus. Or was it a fungus that became an alga? Stay tuned. ■

***Making the most** continued from page 10*

long-term plans will fall by the wayside in the coming 10 to 20 years.

Turfgrass product manufacturers must spend the time and effort to make promising alternative products, strategies, and information available. Turfgrass product suppliers who cling to old product lines and distribution channels, and fail to offer their clients an expanding list of these new "tools", both goods and services, will fade.

As the regulatory pressures grow on turfgrass managers, those manufacturers and suppliers that understand the future and provide answers to future turfgrass management questions will thrive. Those that fail to meet those needs will not survive. ■