as low cutting heights and frequent application of top dressings to reduce stress, as well as occasional rolling for tournaments.

The key and common factor is damage to grass leaves and stems however subtle that may be. I'm reminded of a comment made by David Senior at Vitax describing anthracnose "as tiny discrete yellow patches of infection corresponding to pitch marks left by golf balls and causing sufficient abrasion for fungal entry."

The abrasive effect of tiny silica (sand) particles in top dressings on grass plant surfaces is sufficient to open up grass foliage for anthracnose infection, especially if the dressings are well worked in.

Measures to alleviate stress should be carried out when anthracnose risk is low says Dr Watson, adding how greenkeepers can consult Syngenta's Greencast Website where anthracnose risk is plotted throughout the season on easy to read graphs.

Greenkeepers can use risk forecasts to time proactive fungicide applications more effectively to get the best results, and for tailoring fertiliser applications and synchronising other turf management

The foliar blight form of anthracnose appearing in summer has overtaken the basal rot form of anthracnose historically occurring in autumn

operations, which may impose stress on plants, to periods when anthracnose risk is low.

Access to historical data allows greenkeepers to review what was done and why, thereby providing a full justification of inputs and cost used to tackle those threats.

Changing face of fungicides

Gone are the days when anthracnose was a side issue in autumn turf management and dispatched by fungicide sprays targeted at Fusarium Patch. Anthracnose is now a disease its own right requiring specifically targeted summer sprays when Fusarium is unlikely to be on the greenkeeper's radar.

Contemporary anthracnose is more difficult to manage but the parallel changing face of fungicides has gone a long way to keep the odds in the greenkeeper's favour. Twenty years ago it was unusual to find anthracnose on the fungicide label whereas today it is unusual not to.

Prevention is better than cure. "As it is not possible to treat the advanced stages of anthracnose disease, it remains important to treat at the earliest opportunity," says Joe Kinder.

Dr Watson reminds greenkeepers to remain alert for conditions conducive to the disease, such as high wear areas dominated by annual meadow grass and where outbreaks have been experienced in the past.

Nutrition is recognised as having a central role in grass resilience to anthracnose with tank mixing of fungicides and nutrients increasingly at the forefront of current thinking.

"It is important we take an integrated approach and focus on preparing surfaces without stressing the turf," says Henry Bechelet, "and making sure we get the nutritional inputs right. We also need to use properly targeted fungicides to prevent significant damage taking hold."

Sherriff Amenity is closely focused on tank mixing strategies. "Having pioneered the fungicide and nutrient tank mixing concept, under an extensive trials programme at STRI, we are able to recommend both traditional and novel management options for anthracnose and other commonly occurring turf diseases", says Joe.

There is considerably more depth in the fungicide market for anthracnose management than two decades ago, in appropriate products, more two-and three-way mixes of different actives and versatilities in potency, activity and mode of action.

Rigby Taylor has a six-product fungicide portfolio for anthracnose management.

"We offer a broad spectrum of control options for anthracnose made even more versatile through opportunities to tank mix our products. By adjusting rates greenkeepers can obtain a wide range of fungicide chemistry in a single spray without exceeding the maximum dose rate for an individual product as stipulated on the label," concludes Peter Corbett.

Continuity of disease

Anthracnose clearly appears in two distinct forms at different times of the year. That said both phases are caused by the same fungus living on thatch in saprophytic or weak parasitic mode.

Under combined conditions of high surface wetness/relative humidity and low host 'resistance', the anthracnose fungus moves through the gears into full parasitic mode. Inadequate management of either form of anthracnose, foliar blight or basal rot, will leave than much more inoculum to act as a springboard for the following period of high disease pressure and risk.

about the author

Dr Terry Mabbett

Dr Terry Mabbett is a disease, pest and weed control specialist with forty years international experience covering research, advisory and journalism. His current fields of focus are professional turf and alien insect pests and pathogens of Britain's native and naturalised trees.

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Fusarium ...better the devil you know

Henry Bechelet, Technical Sales Manager at Everris, turns detective to investigate Fusarium and how to deal with it

Know your enemy

If we want to minimise the occurrence of damaging disease attacks, it is essential to know the pathogen and understand what it is trying to do.

The Microdochium patch pathogen, *Microdochium nivale's* single aim in life is to complete its life cycle and reproduce. The problem we have, as turf managers, is that it does this at the expense of the grass plant. The turf, in effect, is the collateral damage.

BASIS

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Stages of life cycle

LAYING IN WAIT

When inactive, *Microdochium nivale* survives in the thatch or soil as microscopic spores or dormant mycelium. The spores can remain viable for up to two years and withstand extremely low temperatures (-20°C). They lie in wait for favorable conditions to develop.

GERMINATION

The spores begin to germinate in cool wet conditions. This can happen at temperatures between 15°C and -6°C with the ideal range being 0-6°C (combined with periods of leaf wetness for more than ten hours a day).

When the spores germinate they produce long, branching hyphae, tubular structures that search for nutrients to fuel further growth and development.

PENETRATION / INFECTION

Specialist hyphae infect the plant by penetrating outer cell walls of leaf sheaths and leaf blades near the soil. Infection can also proceed through the stomata in the leaves and progress rapidly through the plant.

MYCELIAL GROWTH

Nutrient absorbing hyphae draw resource from the plant, which is transported from the host to the fungus to allow it to develop and produce further mycelial networks.

This stage can occur extremely quickly with complete colonisation of the leaf possible in the space of 72 hours. This is when the real damage starts. At this stage, the mycelium growth enables the patches to spread outwards.

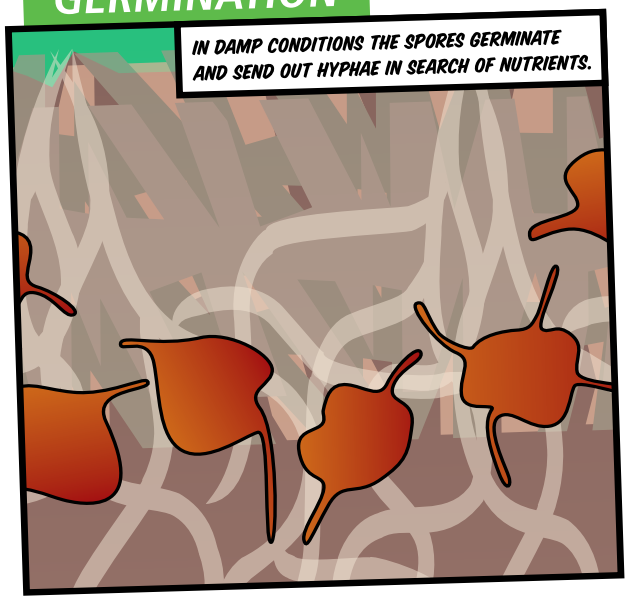
BLISTERING & SPORE FORMULATION

The fungus finally produces fruiting bodies containing spores that are released to disperse in wind and water, continuing the cycle of disease. The pathogen population will boom exponentially if cool, damp conditions persist.

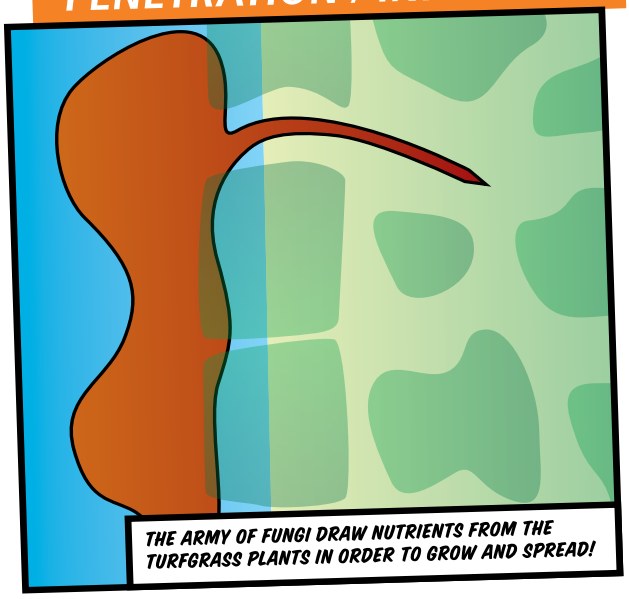
It cannot be emphasised enough that the *Microdochium nivale* pathogen is a merciless parasite. It is solely concerned with its own reproduction, which is achieved by taking resources from its host grass plant. It has no care for the health of the turf and will draw all life from it because the next generation of spores are sent away to find a different host to prey upon.

LAYING IN WAIT

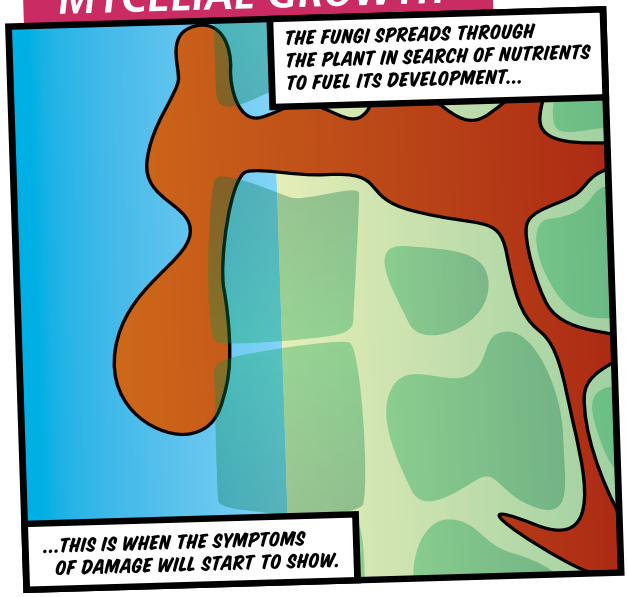
GERMINATION



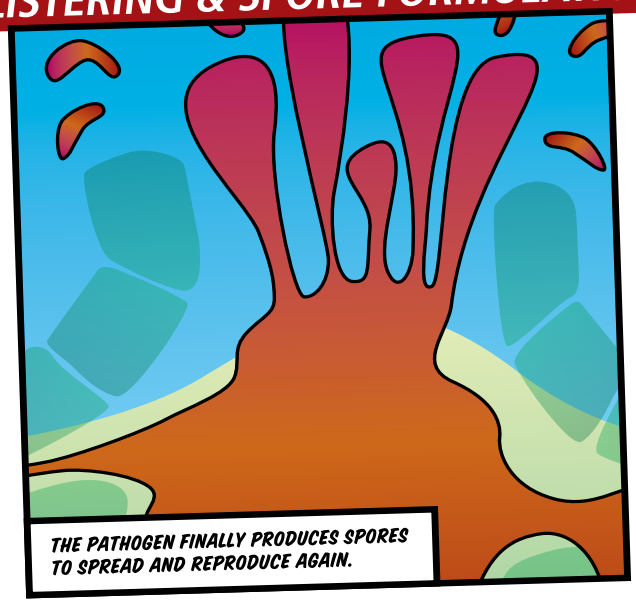
PENETRATION / INFECTION



MYCELIAL GROWTH



BLISTERING & SPORE FORMULATION



Test your knowledge

1. What are the conditions that favour the germination of the Microdochium Patch spores?

2. How does the pathogen fuel its growth and development?

3. What are the main symptoms of Microdochium Patch disease?

4. Why is it best practice to rotate active ingredients or use products with multiple active ingredients?

5. When in the pathogen lifecycle is it best to apply the active ingredient fludioxonil?

BASIS points

Members of the BASIS Professional Register and BASIS Amenity Register- claim two BASIS Crop Protection points (2 CP) by reading this article and testing your knowledge by answering the five self-assessment questions. Please claim your points in the usual way using event attendance code CP/32480/13/g (BASIS Professional Register) and CP/32477/1314/g (BASIS Amenity Register).

BIGGA CPD credits

As part of the new BIGGA CPD Programme, we are offering members the opportunity to gain 1 Professional CPD credit for completing an online quiz relating to this article. We are also seeking your feedback on this, so tell us what you think.

You will need to go to http://www.surveymonkey.com/s/BIGGA_CPD_Fusarium_Quiz, complete the quiz and leave some feedback for your CPD credit.

The symptoms

Initial symptoms begin to show as small brown patches emerging in localised areas. The symptoms are a result of the pathogen causing leaf death due to extensive infection and nutrient withdrawal. Mycelium may also be visible at the edges of the patches as the fungi spreads. As the patches enlarge, the centre becomes water-soaked and paler as a result of the deteriorating leaf structure collapsing and beginning to degrade. These symptoms begin to show quite late in the life cycle of the disease, so early treatment and a preventative approach is essential to limit the potential for extensive damage.

Your disease prevention strategy

Prevention is always better than cure, so it is important to create conditions that will limit the development of the disease. An integrated turf management approach uses all the tools in our armoury to achieve this. Maintaining turf health and reducing the risk of disease attack begins with sound cultural practices, such as:

- Creating a freely draining turf system with soil profile management, thatch reduction and drainage systems
- Keeping the turf leaf as dry as possible by brushing and switching, dew dispersants, managing irrigation inputs, reducing shade and improving airflow
- Maintaining turf health without creating unduly lush growth, especially in autumn
- Maintaining an appropriate soil pH (generally in the region of 5.5 – 6.5)
- Monitoring and a keen awareness of the weather conditions that are favorable to the development of disease
- Making use of disease prediction resources such as the greencast.co.uk website
- Working towards the establishment of grass types with improved disease tolerance
- Using fungicides properly and at an early stage

Fungicide use and spraying

Even with the best cultural practices in place, disease outbreaks can occur if the environment is favourable enough for long enough. Fungicide use should be considered as part of an integrated turf management plan rather than a fire-fighting approach. Using fungicide to control the inoculum, halt the development of the pathogen and protect the plant is good practice, especially if there is a significant risk of damage.

You will know that there are a number of fungicides available and that they can have different active ingredients. In general terms, active ingredients are designed to either target the fungi with direct contact (to interrupt its development) or be situated within the plant itself to repel infection by the pathogen from within. Different active ingredients work in different ways, so it is important to select products that are appropriate for each situation. It is best practice to alternate treatments with different modes of action or use products with multiple active ingredients to prevent fungicide resistance occurring in the fungal population.

Which active?

By way of example, fludioxonil belongs to the phenylpyrrole chemistry group. It is targeted for direct contact with the pathogen and has multi-site activity inhibiting the germination of spores, the creation of hyphae and mycelial growth. It acts in the soil, in the thatch and on the leaf and is best applied preventatively or as an early curative treatment.

Propiconazole is a member of the DMI-fungicides group, and has rapid systemic uptake through the leaf and crown of the plant. It acts on the pathogen from inside the plant, to stop disease development after penetration by interfering with sterol biosynthesis in fungal cell membranes. It is best applied preventatively and is shown to be particularly effective in cooler conditions.

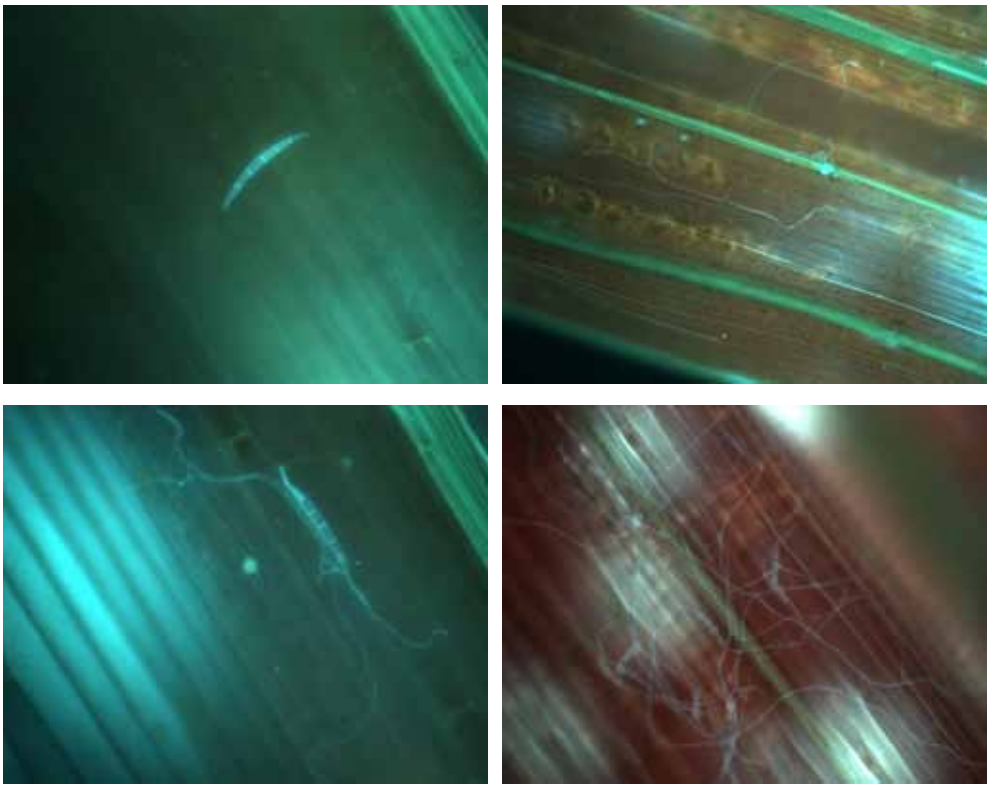
Azoxystrobin is a strobilurin of the QOI group. It is systemic; entering the plant through the roots, crown and leaf, and prevents fungal growth by affecting its cells. This can be applied at any stage but is best applied preventatively.

Some fungicides contain a mix of active ingredients to achieve better control by targeting the pathogen at different growth stages, or in the thatch and soil as well as inside the plant.

Conclusion

Microdochium patch can be an especially damaging disease if given free rein to grow and reproduce. It is important that we work hard to minimise the risk of attack with good management practice. Fungicide treatment is often necessary, and an appreciation of the disease life cycle and fungicides' mode of action will help achieve the best results.

However, the pathogen will never be completely eradicated, so we must remain vigilant and properly prepared. Our essential weapon against Microdochium patch is undoubtedly our knowledge and understanding, which we can use to create an advantage at least. Sometimes, it's better to know the devil.



ABOVE: Fusarium under the microscope

about the author

Henry Bechelet

Henry has been working in the turf and amenity sector for over 20 years. After training to become an agricultural agronomist he joined STRI as a trainee agronomist in 1992. After a couple of years learning the ropes at STRI he went out on the road as Northern Technical Sales Representative for a fertiliser supplier for seven years. Henry rejoined STRI in 2000 as an agronomist and spent the next 12 years looking after his clients as well as building a reputation for thought provoking articles and as an entertaining speaker.

The (not so) elusive butterfly bush

In this latest series of BASIS articles written in association with Sherriff Amenity, Graham Paul looks at the butterfly bush

The Butterfly Bush, Buddleia davidii, was introduced to the UK from China in 1896. It is loved by many gardeners throughout the world for the abundance of beautiful, scented and nectar-rich flowers that attract butterflies, bees and other insects.

It is easy to propagate and has few natural enemies, so once it is established in a garden it will probably remain there in perpetuity. I have chosen to feature this plant because it is a non-native invasive species that can be difficult to control; and also to highlight the controversy that arises from the impact it has on local ecosystems.

The genus Buddleia comprises over 100 species that originate in Asia, Africa and the Americas. The genus was named by the Swedish botanist Carl Linnaeus as a post-humous honour to the Reverend Adam Buddle (1662–1715), a rector and botanist from North Fambridge in Essex, who was the foremost authority on British bryophytes of his era - just imagine what his Sunday sermons were like!

The most common of the buddleias is B.davidii, which gets its species name from a French missionary and naturalist Père Armand David. Buddleias are now classified in the Scrophulariaceae family, a large group of plants that includes; figworts, mullein, toadflax and speedwells. Prior to this they were classified in their own family, the Buddlejaceae.

The Butterfly Bush grows to a height of up to five metres. Flowers are borne in dense, spiked panicles that are mauve-purple with an orange centre. A white flowering variety can also be seen growing in the wild but is less common than the purple flowered species. Originally introduced as a garden bush it has escaped and can be extremely invasive given the right conditions.

The potential for spread of this species is due to the large number of seeds produced by each of the tightly packed flower spikes. It is estimated that a single flower spike can produce as many as 40,000 seeds so a full sized bush could generate as many as 3 million in a year. These lightweight, winged seeds are easily dispersed by the wind and are often caught in the slipstream of lorries and railway trains that can carry them onwards for a considerable distance.

The seeds can remain viable in the soil for three to five years, requiring very little in the way of soil or moisture to germinate and hence they can easily establish in barren ground.

The butterfly bush occurs in a variety of habitats, growing well on poor soils with a preference for disturbed ground and areas recently damaged by fire. It seems to like chalky and lime soils, waste ground and will also proliferate on riverbanks.

Another favourite habitat is railway property; where it easily establishes in the ballast of the track and cess and any mortar filled brickwork is a definite invitation to put down Buddleia roots! It is believed that the lime in the mortar provides the right conditions for the plant to establish, so the seeds just need to find a tiny opening in the brickwork to take hold.