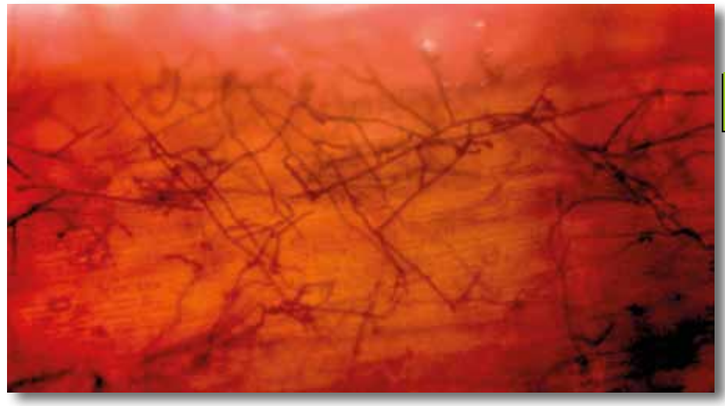


New native patch diseases put to the test

Two new fungal pathogens causing patch diseases in Australia were studied to determine their temperature, moisture and pH requirements in the hope that the information leads to practical methods to manage their impact.

Diseases caused by fungi occur year round and detract from the visual appeal of fine turf surfaces. For such diseases to occur, there are three key factors which are needed – the actual pathogen, a susceptible host and favourable weather conditions.

By understanding this disease triangle, we can gauge what conditions favour the development of two new native Australian turf pathogens, Wongoonoo patch (*Gaeumannomyces wongoonoo*) and an undescribed *Magnaporthe* sp which have been isolated and discovered by Dr Percy Wong from the University of Sydney.

Both of these diseases are ectotrophic root-infecting fungi, or 'ERI fungi', which is a generic name given to fungi which cause a number of diseases in turf, such as Take-all patch (*Gaeumannomyces graminis* var. *avenae*) and spring dead spot (*Ophiosphaerella namari*). These fungi typically produce a black mycelium on the surface of the roots, before they invade the roots inciting disease. As they grow below the turf surface chemical control is often difficult to achieve.

METHODOLOGY

Two isolates of *G. wongoonoo* (GW1 from Perth, WA and GW5 from Brisbane, QLD) and three isolates of the undescribed *Magnaporthe* sp. (TS99 from Indooroopilly, QLD; TS124 from Mackay, QLD; and Dan from Dandenong, VIC) were studied as part of this project to determine their growing requirements. Such knowledge can help turf managers in the future better anticipate and hopefully combat these two diseases.

Essentially, an isolate is the term given when an identical species is found in a different site, usually separated by great distances. It is also interesting to see how these species adapt to different environments, such as different tolerances to heat/cold. For all experiments there were three replicates.

Three experiments were carried out under laboratory conditions and for each experiment the fungi were measured every two days to determine their mean radial growth. The experiments were:

- **Experiment 1:** Fungal growth measured between 10°C-35°C at 5°C increments;
- **Experiment 2:** Osmotic potential of the fungi, in particular, how moisture influences the growth of fungi (the lower the osmotic potential, the 'drier' the conditions are); and
- **Experiment 3:** Response to pH changes from 5.0 to 8 at 0.5 unit increments. (This is an interesting experiment as many turf diseases have been shown to be effectively controlled by altering pH, with the prime example being Take-all on golf greens.

WONGOONOO PATCH

Wongoonoo patch is caused by *Gaeumannomyces wongoonoo* (Wong 2002). The symptoms of this patch disease look very similar to Take-all patch of golf greens. Visual symptoms include patches of unthrifty grass exhibiting yellowing of the leaves, stunting and eventual death of the runners (especially in the centre of patches). These patches can measure up to 50cm in diameter. Under a hand lens, the roots are dark in colour which occurs as a line in the centre of the roots rather than occurring throughout the root.

The disease was originally found on ST1191 buffalograss in Perth, Western Australia and it has also been found on buffalograss in Brisbane, Queensland (*Stenotaphrum secundatum* cv. 'Velvet') and has been identified by Dr. Percy Wong as the cause of a patch disease of common couch in Parramatta, New South Wales.

The results of this research project showed that this disease is favoured by warm weather conditions, with optimum growth at 25°C-30°C. Below this range the pathogen did not grow well, so it can be deduced that the turf will out-compete the fungus in these situations. *G. wongoonoo* also favours a wet soil. As with many fungi, constant irrigation will germinate the fungal spores, which not only incite disease but may also facilitate its spread. The fungus also grew in extremely dry soil conditions, albeit very slowly. This is likely to be an adaptive mechanism of the fungus to accommodate new environments.

Above: Two new native Australian turf pathogens, Wongoonoo patch (*Gaeumannomyces wongoonoo*) and an undescribed *Magnaporthe* sp, which are ectotrophic root-infecting fungi which is a generic name given to fungi which cause a number of diseases in turf, such as Take-all patch

WORDS: BEN EVANS PHOTOS: DR. PERCY WONG AND MARCELLA STERLING

A diseased buffalograss runner infected by Wongoonoo patch (left) compared to a healthy runner (right), in a glasshouse test

Below: Figure 1. *G. wongoonoo* isolates showing severe decline in growth as the growing media becomes more acid

Bottom: Figure 2. Undescribed *Magnaporthe* sp. isolates showing severe decline in growth as growing media becomes more alkaline

This study found the pathogen grew very well on neutral to slightly acid pH ranges (pH 7-6.5) and poorly under acid conditions (Figure 1). As the solution became more acid (<pH 6) growth was stunted.

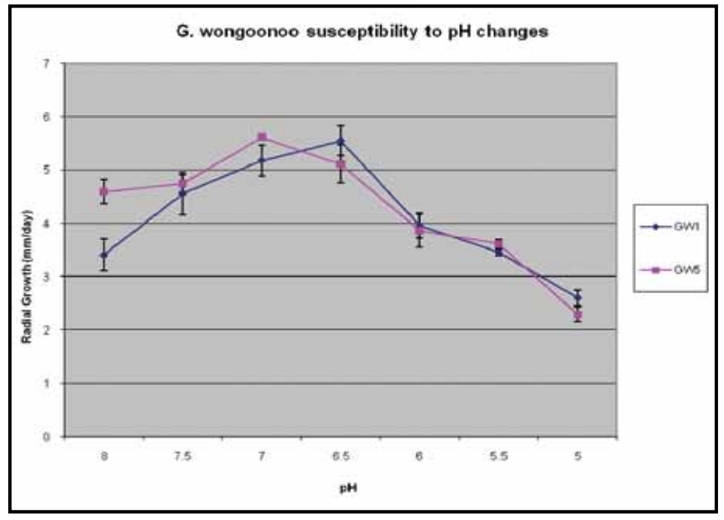
There have been a number of studies examining the control of Take-all patch with acidifying fertilisers. For instance, Dernoeden (1987) found lowering soil pH with ammonium sulphate to be an effective practice. Further research has shown that the use of acidifying fertilisers also increases manganese availability, which has been shown to reduce Take-all patch (Heckman et al. 2003).

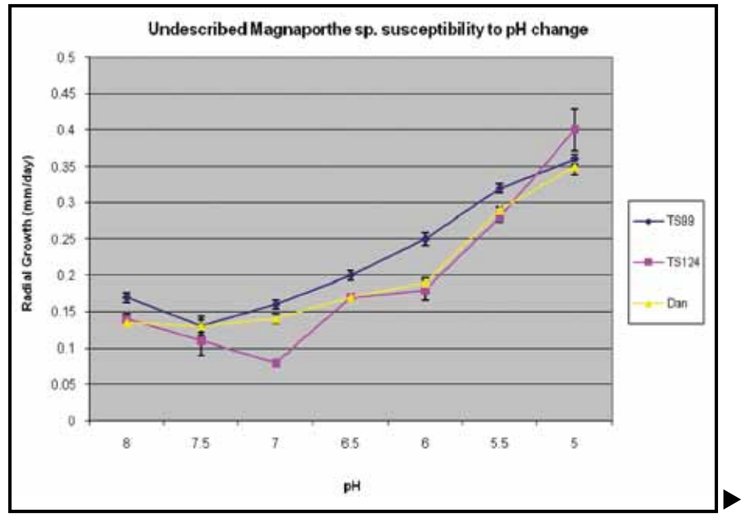
As the species tested is a close relative to Take-all patch (*G. graminis*), chemicals which control Take-all may prove effective. Until such chemical trials are undertaken, turf should be watered deeply and infrequently to allow some drying of the soil. Other management practices to consider are:

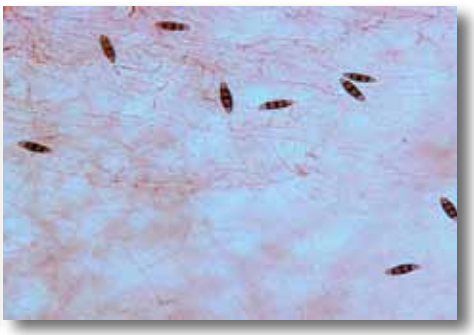
- Lifting mowing height;
- Syringing on hot days to cool the surface;
- Invasive procedures to the surface, such as de-thatching, will help spread the disease;
- All equipment should be thoroughly cleaned before entering new areas;
- Application of N fertilisers may help to mask symptoms; and
- Liming should not be undertaken if the turf has a history of Wongoonoo patch.

UNDESCRIBED MAGNAPORTHE

This patch disease, called 'summer decline' by golf superintendents, was first discovered on 328 (Tifgreen) couchgrass golf greens in Queensland and has since been discovered as far north as Mackay, Queensland, and in a playing field as far south in Dandenong, Victoria. The cause of the disease is an undescribed fungus which is currently being studied by Dr. Percy Wong from the University of Sydney.







Above: Typical symptoms of Wongoonoo patch on a Velvet buffalograss home lawn

Middle: The undescribed *Magnaporthe* sp 'TS99' infecting a hybrid couchgrass putting green

Right: Ascospores for this undescribed *Magnaporthe* are unique in size to other members of the genus

The disease begins as small, brown patches which enlarge and coalesce with other patches to form weakened and unsightly turf. These patches are irregular in shape, and exhibit wilted plants with rotted roots colonised by a dark ectotrophic fungus. This is most severe in the summer months, hence the name 'summer decline', when high temperatures exacerbate the symptoms, largely due to the weakened root systems being unable to supply enough water to the grass, therefore causing the grass to die back.

This research project found that this pathogen grows best at 25°C-30°C, while outside these ranges growth was negligible. What separates this *Magnaporthe* sp. from *Magnaporthe poae* (which causes 'summer patch' in the US) was its slow growth. This species grew at 0.8mm/day at its fastest, which in fungi terms is very slow, compared to M. poae which grew at 6.5mm/day (Plumley et al. 1997). While it is a slow growing fungus, this shouldn't detract from its severity. If turf roots and microbial antagonists are suffering under extreme heat, this fungus can happily survive such conditions and easily gain a competitive advantage over the turf.

This fungus is also favoured by wet soils. As the growing media became drier, the growth of the fungus deteriorated. Managers who water lightly yet frequently may find this will encourage symptom development.

This fungus is favoured by a soil pH of 5-5.5. As the growing media became more alkaline, growth of the fungus dropped by over 50 per cent. In a recent paper, Heckman (2003) and colleagues in the US found the use of ammonium sulphate, an acid inducing fertiliser, to greatly reduce the severity of summer patch. In an earlier study, ammonium sulphate reduced severity of summer patch by 75 per cent compared with the same rate of calcium nitrate (Thompson et al. 1993).

Since the new pathogen is a *Magnaporthe* species, it is possible they may respond to fungicidal treatments used in the US for the control of summer patch (which has not yet been recorded in Australia). Any process which encourages root growth, such as raising mowing heights, verti-draining and judicious fertilisation is recommended. Any abrasive practice such as grooming or dusting should be avoided.

It is also recommended from this study that liming should be undertaken to combat this disease. At a pH of 6.5 and upwards, this pathogen grew quite poorly, and it seems this shift in pH will inspire microbial antagonism on this debilitating fungus.

SUMMARY

From this research, both diseases are favoured by high temperatures and wet soils, and have unique requirements for pH. Chemical control for ERI fungi is difficult at the best of times, as the diseased parts exist largely below ground.

It is uncertain as to what mechanisms are triggered to influence disease severity when the soil pH is altered, whether this is a shift in microbial antagonism or greater amounts of Mn becoming more available. Until chemical trials are undertaken, any practice to benefit the health of the turf should be considered, such as raising mower heights and the judicious use of fertilisers.

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REFERENCES

Dernoeden, P. (1987). *Management of Take-All Patch of Creeping Bentgrass with Nitrogen, Sulfur, and Phenyl Mercury Acetate. Plant Disease 71, 226-229.*

Heckman, J. et al (2003). *Optimising Manganese Fertilisation for the Suppression of Take-All Patch Disease on Creeping Bentgrass. Crop Science 43, 1395-1398.*

Hill, W et al (2003). *Summer Patch Disease Severity on Kentucky Bluegrass in Response to Fertiliser Source. Journal of Plant Nutrition 26, 1499-1512.*

Plumley, K. et al (1997). *Impact of Temperature, Osmotic Potential, and Osmoregulant on the Growth of Three Ectotrophic Root Infecting Fungi of Kentucky Bluegrass. Plant Disease 81, 873-879.*

Thompson, D. et al (1993). *Influence of Nitrogen Source and Soil pH on Summer Patch Development in Kentucky Bluegrass. International Turfgrass Society Research Journal 7, 317-323.*

Vargas, J. (2005). *Management of Turfgrass Diseases 3rd Edition. (John Wiley & Sons: New Jersey)*

Wong, P. (2002). *Gaeumannomyces wongoonoo sp. nov., The Cause of a Patch Disease of Buffalo Grass (St Augustine Grass). Mycological Research 106, 857-862.*