

Turf Research

Environment friendly control of black beetle

Biological control is one of the options for pest management in turf but many products lack data to support manufacturers' claims. As a result, the VGA Turf Advisory Board, in association with the Victorian Golf Course Superintendents' Association, has planned trials to identify biological control potential. An independent trial into biological control of Black Beetle larvae conducted by Peninsula CGC superintendent David Nickson, in conjunction with CSIRO scientist Dr Robin Bedding, displayed the effectiveness of one particular biological control method. Here, Nickson reports on the trial and results.

Golf courses have received a good deal of criticism in recent years over possible damage to the environment, especially in regard to the use of pesticides.

This criticism has had some beneficial consequences due to extensive research into what happens to the pesticides once they have been applied and by greater concentration on an integrated pest management program.

Biological control measures are one of the options now available for use in this integrated approach, with the potential to assist in the control of pests as diverse as poa annua in greens, to insect and fungal infections generally.

The VGA Turf Advisory Board in association with the Victorian Golf Course Superintendents' Association intend to stage a series of trials in an attempt to identify product potential for use in the turf industry. One biological source used for the purpose of insect control is entomopathogenic nematodes (ENs). Nematodes are normally

associated with the potential to cause severe damage to golf greens but there are certain species that survive by feeding on insects.

In Australia, the most outstanding success using ENs occurred with the control of Sirex wasp infestations in pine tree plantations and Dr Robin Bedding, an entomology research scientist at the CSIRO in Canberra, did this work.

For more than 20 years, Dr Bedding has researched ENs and their potential for insect control and in particular the control of scarab larvae, a significant pest of both pasture and turf.

The genus of the ENs utilised by Dr Bedding for scarab larvae control is heterorhabditids. This species is able to detect the scarab from its movement in the soil and an increase in carbon dioxide concentration. It then enters the scarab larvae and after releasing the bacteria xenorhabdus, the scarab larvae dies from septicemia. This EN was shown to be effective against the Argentine scarab (*cyclocephala signaticollis*) larvae in



Staff at The Peninsula CGC Ashley Grice and Peter Manning, count larvae in the test plots

Canberra and further investigation was required to determine its potential use for control of African black beetle larvae.

A replicated trial in association with Dr Bedding commenced at The Peninsula Country Golf Club in early February on a site known to be infected with African black beetle larvae. A randomised complete block design was used with each plot measuring two and a half by four metres. Four treatments were each replicated three times. Two rates of ENs, a much lower dose of ENs combined with a very low rate of an insecticide that has proven to be effective for scarab control and an untreated control made up the treatments. The numbers of nematodes applied were: Treatment one: Normal rate of nematodes 500,000/m²; Treatment two: Half rate of nematodes 250,000/m² Treatment 3: Control and Treatment 4: Combination nematodes plus insecticide 50,000/m² in conjunction with 40gm of imidacloprid.

The application was made at dusk to minimise the loss of ENs due to UV exposure and they were applied through a boom spray with all filters removed, two hundred litres of water per hectare was used as the carrier. The nematodes then had 10 mm of irrigation applied and the area was kept moist. This irrigation allows the ENs to move into and through the thatch on a water film. It is yet to be determined if mechanical disruption to the turf surface such as coring or scarifying would improve ENs' movement into and through the thatch layer but more than likely this would tend to be a site specific issue and would relate to soil type and moisture content.

After four days, an informal inspection showed dead larvae in the ENs' plots. A formal inspection was made 14 days after treatment that involved removing sections of turf and soil from each plot measuring two metres by 300mm by 100 mm deep. Live and dead larvae and pupae were then counted. Both rates of nematodes killed 50 per cent of insects counted and after the initial count only Treatment 2 (the low nematode rate) and the control were assessed. One week later, 75 per cent of insects counted had been killed in

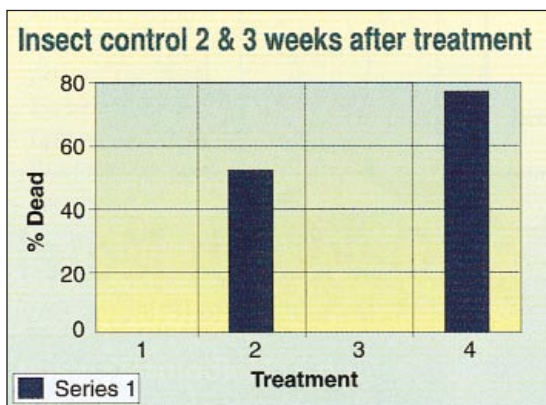


By mid March, it became noticeable that bird damage was still occurring in all of the control plots (left, plot 3). In stark contrast to this were the treated plots where no evidence of bird damage was observed (right, plot 4)

Treatment Two receiving the low rate of nematodes. No dead larvae were found in the untreated control apart from a couple of insects infected with a fungus while the combination EN-insecticide gave the poorer control of 28 per cent. Further informal counts in the low rate nematode plots gave control up to 100 per cent.

interesting issues that may influence improved efficacy and affordability with further work. Some of these include improved application techniques and the nematodes' potential to last more than one season (they will survive only if there are insects they can feed on). There is also the possibility of lower application rates, the further development of improved EN strains, genetic engineering to reduce the problems associated with UV exposure and desiccation. The screening of other insect pests for possible susceptibility and the identification of other nematodes that may have potential for further pest control are also strategies worthy of consideration. The use of ENs for the control of scarab larvae and potentially the control of other insects in amenity turf gives the turf manager an effective alternative to current pesticides registered for this purpose.

It also provides a responsible approach from an environmental perspective that need not be applied as a preventative against anticipated scarab infestations but used as a curative control technique.



Column 1: Treatment 3, control, two weeks after application

Column 2: Treatment 2, low rate of nematodes (250,000/m²), two weeks after application

Column 3: Treatment 3, control, three weeks after application

Column 4: Treatment 2, low rate of nematodes (250,000/m²), two weeks after application

After infecting the insects, the nematodes feed and reproduce resulting in a dramatic increase in nematode numbers and consequently infection of other larvae and pupae escalates. This accounts for the increased efficacy over time.

Although there were not any counts taken, there were dead billbug (*sphenophorus brunnipennis*) larvae and pupae observed in the plots where nematodes were applied and not in the untreated control plots.

Further counts did not reveal any significant differences between the treatments as the insect life cycle had been completed in the control plots and in some of the lots that had been treated with nematodes up to 100 per cent of the larvae had been killed. There are some