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Biological Control of Black Beetle Larvae (Heteronychus arator)

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The criticism, from an environmental perspective of golf course development and maintenance over recent years has had some beneficial consequences due to extensive research conducted into pesticide fate and the greater concentration on integrated pest management for amenity turf.

Biological control measures are one of the options now available for use within an integrated approach to pest control in agriculture and turf with the potential to assist with the control of pests as diverse as Poa annua in greens, to insect and fungal infections generally. Unfortunately many products lack specific data to support manufacturers claims of efficacy and due to these shortcomings the VGA Turf Advisory Board in association with the Victorian Golf Course Superintendents Association intend to run a series of trials in an attempt to identify product potential in the turf industry.

One of these biological sources used for the purpose of insect control is entomopathogenic nematodes (ENs). Nematodes are normally associated with the potential to cause severe damage to golf and bowling greens but there are certain species that survive by feeding on insects. In Australia, the most outstanding success using ENs has occurred with the control of Sirex wasp infestations in pine tree plantations. This work was done by Dr Robin Bedding, research scientist of CSIRO Entomology, ACT. For a period of in excess of 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 larvae 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 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 1999 on a site known to be infected with African Black Beetle larvae. A randomised complete block design was used with each plot measuring 2.5 metres by 4 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 number of nematodes applied were (1) 500,000/m^2 - (2) 250,000/m^2 - and (3) 50,000/m^2 in conjunction with 40gms of imidacloprid.

Treatment 1. Normal rate of nematodes.

Treatment 2. Half rate of nematodes.

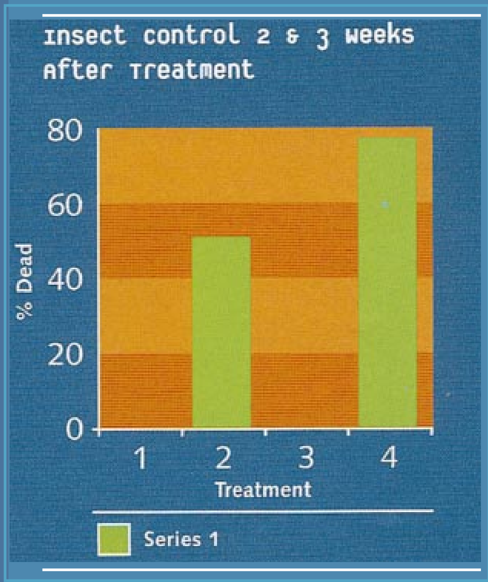
Treatment 3. Control.

Treatment 4. Combination nematodes + insecticide.

The application was made at dusk to minimise the loss of ENs due to UV exposure and they were applied through boom spray with all filters removed, two hundred litres of water per hectare was used as the carrier. The nematodes then had 10mm of irrigation applied and the area was kept moist. This irrigation allows the ENs to move into and through the thatch on a film of water. 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 4 days an informal inspection showed dead larvae in the ENs plots. A formal inspection was made 14 days after treatment which involved removing sections of turf and soil from each plot measuring 2 metres by 300mm by 100mm deep. Live and dead larvae and pupae were then counted.

Both rates of nematodes killed 50% of insects counted and after the initial count only the low nematode rate, treatment 2 and the control were assessed. One week later 75% of insects counted had been killed in treatment 2 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%. Further informal counts in the low rate nematode plots gave control up to 100%



Treatment 1. Control. 2 weeks after application.

Treatment 2. Low rates of nematodes ($250,000/m^2$). 2 weeks after application.

Treatment 3. Control. 3 weeks after application.

Treatment 4. Low rates of nematodes ($250,000/m^2$). 3 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.

By mid March it became noticeable that bird damage was still occurring in all of the control plots. In stark contrast to this were the treated plots where no evidence of bird damage was observed. Further counts did not reveal any significant differences between the treatments as insect lifecycle had been completed in the in the control plots and in some of the plots that had been treated with nematodes up to 100% of the larvae had been killed.

There are some 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 only survive 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 associated with UV exposure and desiccation. The screening of other insect pests for possible susceptibility and the identification of other nematodes that may have the 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.

Bird Damage

Untreated Conted Controls Treated with EN,s

References

Nematodes and the biological control of insect pests.

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