

A COMPARISON OF METARHIZIUM ANISOPLIAE, INSECT PARASITIC NEMATODES AND FONOFOS AGAINST VINE WEEVIL IN CYCLAMEN

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Introduction

Since the withdrawal of aldrin there has been a need to find an effective alternative for the control of vine weevil (*Otiorhynchus sulcatus*) in ornamentals. Biological control is an environmentally and user friendly alternative to insecticides. It is also the most practical strategy where natural enemies are already in use against other pests such as whitefly (*Trialeurodes vaporariorum*) and red spider mite (*Tetranychus urticae*). This experiment was therefore designed to compare two commercially available parasitic nematodes *Steinernema feltiae* (as Nemasys™), and *Heterorhabditis megidis* as (Nemasys H™), the fungal pathogen *Metarhizium anisopliae* (Bayer BIO 1020) and the insecticide fonofos for control of vine weevil in cyclamen.

Methods

A randomised block design with eight replicates of seven treatments was set up. Two treatments of *M. anisopliae* (BIO 1020; dust free granule of fungal mycelium; Bayer) at 1 g litre⁻¹ of compost were tested, with the fungus incorporated in compost 14 days before and at potting on. Nemasys™ (*S. feltiae*; nematodes supplied in moist clay; AGC Microbio) was applied at potting-on and six weeks later. Nemasys H™ (*H. megidis*; nematodes supplied in moist clay; AGC Microbio) is recommended for control of existing populations of vine weevil and so was applied six weeks after egg inoculation. The efficacy of this product as a prophylactic treatment at potting-on was also investigated. Both Nemasys™ and Nemasys H™ were applied in 100 ml of aqueous solution per pot, with a syringe. This volume contained approximately 50,000 nematodes with Nemasys™ and approximately 17,000 nematodes with Nemasys H™. Fonofos (Cudgel; 39.2% w/w aqueous formulation; ICI) was incorporated in compost at 100 ml 40 litres⁻¹ water per litre of compost. Established cyclamen plants were potted up in 12.5 cm-diameter pots of the various compost treatments and each inoculated with 80 vine weevil eggs collected over a three week period from a laboratory culture of the pest. Plants were maintained on a sandbed in a heated glasshouse at 25°C. Nine weeks after the first egg inoculations, plant vigour was assessed on 0-3 scale (0 = plants dead, 1 = growth severely impaired, few healthy leaves, 2 = few dead leaves, 3 = no visual signs of attack). The numbers of vine weevil larvae in each pot were also recorded following flotation of the compost in concentrated magnesium sulphate solution.

Results

Both *M. anisopliae* treatments, Nemasys™ and Nemasys H™ had significantly fewer larvae than the control and pots treated with Nemasys H™ at potting on ($P < 0.05$, Table 1). Numbers of larvae were also significantly smaller in the Nemasys™

Table 1. Plant vigour (0-3) and mean numbers of vine weevil larvae ($\sqrt{x+1}$ transformed values) nine weeks after treatment with a range of biological control agents and fonofos. Values followed by the same letter are not significantly different ($P < 0.05$, Duncan's multiple range test).

| Treatment | Mean plant vigour score | Mean numbers of larvae per pot |
|--|-------------------------|--------------------------------|
| 1. Untreated control | 1.1 | 7.3 (2.7 c) |
| 2. <i>M. anisopliae</i> incorporated at potting-on | 0.9 | 2.3 (1.6 ab) |
| 3. <i>M. anisopliae</i> incorporated 14 days before potting-on | 1.3 | 1.0 (1.3 a) |
| 4. Nemasys TM at potting-on and 6 weeks later | 2.1 | 0.6 (1.2 a) |
| 5. Nemasys H TM applied 6 weeks after egg inoculation | 0.5 | 1.3 (1.4 ab) |
| 6. Nemasys H TM at potting-on | 1.3 | 9.1 (3.1 c) |
| 7. Fonofos incorporated in compost at potting-on | 1.4 | 5.3 (2.4 bc) |
| SED (49 DF) | 1.65 | (0.47) |

treatment and in pots where *M. anisopliae* was incorporated 14 days before potting on, than in those to which fonofos was applied ($P < 0.05$).

Discussion

Results indicate that both *M. anisopliae* and Nemasys TM give good control of vine weevil larvae. Plant vigour scores show that Nemasys TM-treated plants were generally more healthy than those grown with incorporated *M. anisopliae*. As both treatments controlled vine weevil well it is likely that Nemasys TM is the faster acting of the two. A fungal pathogen must first multiply and spread through the compost before it has any significant effect on the pest. With Nemasys TM the parasite is inoculated in an active condition and in sufficient numbers to exert immediate control. Fonofos, which is approved for vine weevil control in pot plants and container-grown nursery stock, gave poor control of the pest. However, a drench treatment which is recommended six weeks after compost incorporation was not applied.

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