Report from Slug Control Meeting

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Slugs and snails are pests of agriculture and horticulture throughout the world. To meet the challenge of this growing problem, a meeting was held under the COST 850 Action to produce a slug control website, linked to the COST 850 website and to identify areas of knowledge lacking in order to prioritise research needs

At the meeting it was decided in the light of the many high quality web-based resources for slug control, we only needed to produce a short overview of the use of *P. hermaphrodita* including hyper-links to the most relevant websites. The website has now been completed (http://www.abdn.ac.uk/organic/organic_21_2.php) and below is our report on research needs and priorities.

Other useful sites for information on slug control include:

http://www.cf.ac.uk/biosi/research/biodiversity/staff/wocs2.html

http://www.slugcontrol.rothamsted.ac.uk

Background

It was acknowledged that while the area of land being treated with *P. hermaphrodita* is increasing, it is still very small compared with the area treated by chemical molluscicides. The meeting identified high cost of the product as the major constraint to widespread use. Costs could be reduced by increasing production efficiency, extending storage time, reducing the need for refrigeration or devising novel application methods to reduce nematode dose and maximise nematode survival and efficacy.

Nematode Production and Storage

Nematode production and formulation have been intensively studied by several nematode-producing companies over twenty years. While it is acknowledged that there will be incremental improvements in production and storage efficiency, these alone are unlikely to reduce the costs sufficiently.

Reducing Nematode Application Rates

The recommended application dose for *P. hermaphrodita* is currently 300,000 nematodes per m^2. Since it is rare to get more than 300 individual slugs per m^2 and a single nematode can infect and kill a slug, we believe there is much scope for lowering this dose and hence associated costs.

The meeting identified three possible strategies to reduce the dose:

Repeated low dose applications. These offer the advantages of reducing any post-treatment effects of slug immigration, are less likely to fail as a result of poor environmental conditions at application, and will minimise intra-specific competition effects of *P. hermaphrodita* infective juveniles. This approach has been adopted in the Netherlands, with preliminary data suggesting nematodes may be applied as two doses of 50,000 m^2 representing a 67% reduction in numbers. Other studies with the related entomopathogenic nematodes suggest that repeated low dose application can reduce numbers of applied nematodes by up to 75% (Fenton *et al.,* 2002).

Band or patch application. It is known that presence of *P. hermaphrodita* makes soil repellent to slugs (Wilson *et al.,* 1999). Thus it may be possible to protect plants by treating a small area immediately adjacent to the plants with nematodes that will act as a repellent barrier to slugs, and also will infect slugs reducing the overall population. Albert Ester has reported good results with this approach in glasshouse cymbidium, but as yet these are unpublished. Hass *et al.,* () were unable to demonstrate a repellent effect in an experiment using wheat treated with narrow bands of nematodes. Clearly more research is needed to understand these inconsistencies.

Application of nematodes to slug shelters/bait stations. Grewal *et al.,* (2001) placed nematodes under slug shelters. Slugs visiting the shelters became infected, and this approach gave similar protection to conventional application using only a third of the nematode dose. This strategy would be impractical in arable agriculture, but could be useful in protected high value crops.

It was concluded that research into the above three application strategies is urgently required, and this is the most likely way to increase market uptake of *P. hermaphrodita* in the near future.

Further Research Needed

Other areas of knowledge lacking were discussed and the following topics were identified.

- Our knowledge of the host range of *P. hermaphrodita* and the effect of slug age on susceptibility is inadequate. This applies particularly to the spreading invasive slug *Arion lusitanicus.*

- Understanding the extent of slug problems in high value ornamental crops and their potential to be solved using *P. hermaphrodita.*

- Field persistence and post application survival of *P. hermaphrodita* and its effect on long term slug population dynamics. Gaining this knowledge is being inhibited by inadequate techniques for studying *P. hermaphrodita* in the field.

- Diversity of slug/nematode parasitism. All published research on use of *P. hermaphrodita* has used a single strain of this nematode. It is likely that new strains, species, and genera of nematodes parasitising slugs could be developed for biocontrol.

- Nematode/Bacterial associations. The role of bacteria in morbidity to slugs caused by *P. hermaphrodita* is not understood. Nobody has studied bacteria associated with natural populations of *P. hermaphrodita.* Identifying the optimal nematode/bacterial association could improve efficacy and safety of products.

It is not possible to prioritise the above topics as all are interrelated and essential to fully exploit the potential of nematodes as molluscicides. Regional, national and international funding agencies should be approached, in collaboration with industry, to support the above. It is also essential that research is co-ordinated across Europe.

References

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