Development of fungal biopesticides for use against green vegetable bugs and mirids.

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Introduction

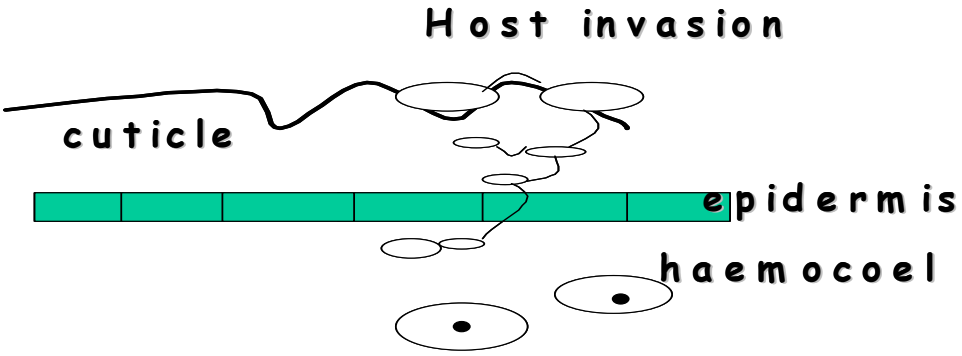
Beauveria bassiana (Balsamo) Vuillemin and *Metarhizium anisopliae* (Metschnikoff) Sorokin are naturally occurring entomopathogenic fungi that infect sucking pests including *Nezara viridula* (L) (green vegetable bug) and *Creontiades* sp. (green and brown mirids) (Sosa-Goméz & Moscardi, 1998). Fungi have the unique ability to attack insects by penetrating through the cuticle making them ideal for control of sucking pests (Fig 1) (Sosa-Goméz & Moscardi, 1998). Sucking pests are less susceptible to control by bacteria, viruses, and protozoans because unlike chewing pests such as caterpillars, the proboscis penetrates the plant tissue avoiding infection from other diseases (Milner, 1994). Although *B. bassiana* has a large host range (over 700 species) research indicates that certain strains of the fungus are much more host specific, indicating that *B. bassiana* may not impact adversely on natural enemy populations.

B. bassiana is currently registered in the United States as Mycotrol ES® (Mycotech, Butte) and Naturalis L® (Troy Biosciences). These products are registered against sucking pests such as, whitefly, aphids, thrips, mealybugs, leafhoppers, and weevils. Studies also show that *B. bassiana* is virulent against *Lygus hesperus* Knight (Hemiptera: Miridae), a mirid species that is a major pest of alfalfa and cotton in the United States (Noma & Strickler, 2000).

At present in Australia, control of green vegetable bug and mirids has been almost exclusively reliant on applications of the broad-spectrum insecticides deltamethrin and dimethoate respectively. Resistance to insecticides in *Helicoverpa* sp. has led to the increased implementation of integrated pest management (IPM) and area wide management (AWM) in cotton growing areas (Ferguson & Miles, 2002, Johnson et al, 2000). AWM includes the use of more selective insecticides such as nucleopolyhedrosis virus (NPV) and *Bacillus thuringiensis* (Bt) for *Helicoverpa* sp.

control. Single applications of dimethoate can double *Helicoverpa* sp. numbers within ten days (Knight et al, in preparation). Therefore, more selective control measures are required for the control of sucking pests such as mirids and green vegetable bug to complement *Helicoverpa* sp. IPM and AWM strategies.

Figure 1. Mode of action of fungal biopesticides.



What have we done so far?

At the DPI Biopesticides Unit we have access to the two American products, Mycotrol ES® and Naturalis L®, as well as a collection of native isolates taken from mirids, green vegetable bug, and natural enemies such as damsel bugs. In the 2001/2002 season we conducted three field trials to ascertain the impact of some of our isolates and the commercial products on mirids in mungbeans as well as any activity against damsel bug, which is an important natural enemy of *Helicoverpa* sp. Our isolates are applied in a ULV applicator in a carrier oil the commercial products are emulsifiable solutions.

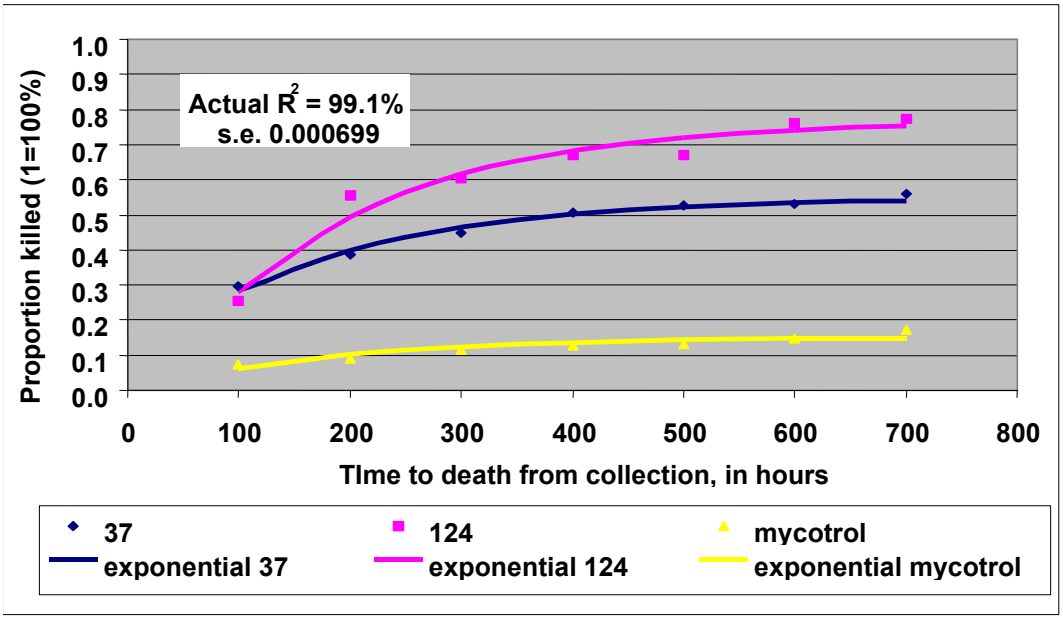
This season we have started testing isolates in the laboratory against green vegetable bug nymphs to ascertain which ones are virulent against this species and will conduct field trials in soybeans.

What have been the results?

Mirid trials. Our objective for the three trials was to determine whether *B. bassiana* is able to infect and reduce mirids in a mungbean system and to assess *B. bassiana* infection in mirid populations. In trial one we compared two of the QDPI isolates with

Mycotrol ES® and Naturalis L®. We found that the QDPI isolate EFD 37 suppressed mirid populations to a greater extent than both the commercial products and halved mirids compared to the unsprayed control. Results also showed that the fungal treatments had a greater impact on mirid nymphs than adults. There was no significant impact on damsel bugs during this trial. Trial two was conducted at the same time as trial one however, mirids were brought back to the laboratory to assess the rates of fungal infection. The results from this trial indicate that time to death for mirids after fungal biopesticide application is 9 days after treatment (Fig 2).

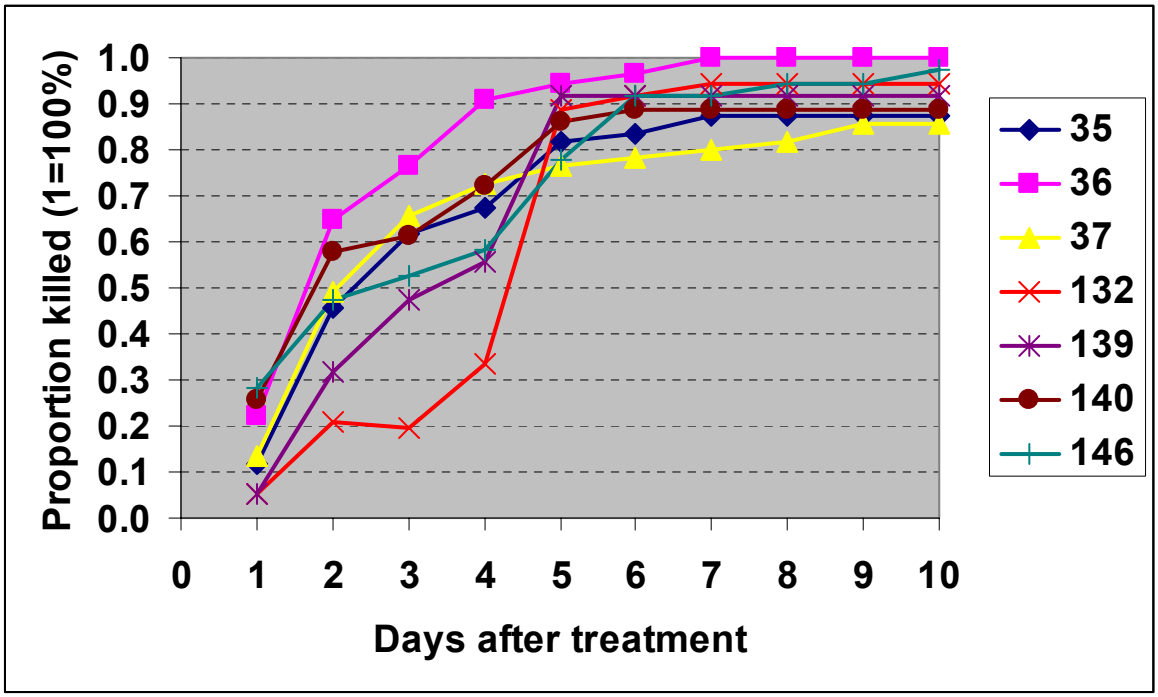
Figure 2. Time to death from collection for mirids.



The third trial compared QDPI isolate EFD 124 at three doses with Mycotrol ES® at the same doses as well as the carrier oil that EFD 124 was applied in. Again, we found that the fungal treatments had a greater impact on mirid nymphs and that by eight days after treatment EFD 124 at the lowest dose was significantly better than Mycotrol ES®. There was a formulation effect indicating that ULV application for fungal biopesticides may be more effective than emulsifiable solutions. The results indicated that the carrier oil had no effect on mirid populations. As with the previous trial we found no significant impact of any fungal treatment against damsel bug.

Green vegetable bug bioassays. Initial bioassays with 1st instar green vegetable bug nymphs indicate that one isolate in particular (EFD 36) is pathogenic to this species. With this isolate there is 100% mortality by 7 days after treatment. However, it is important to note that this isolate killed almost 80% of the 1st instar green vegetable bug nymphs in three days. These bioassays will continue and we plan to import some new isolates from the USA.

Figure 3. Time to death for 1st instar green vegetable bug nymphs after application of fungal isolates.



Conclusion

The results indicate that both green vegetable bug and mirids are susceptible to *B. bassiana*. The work will continue over the next couple of seasons to establish field efficacy and any impacts on natural enemies. It is important for us to know that we are not 'flaring' other pests such as *Helicoverpa* sp. Because fungal biopesticides take longer to kill pests than the current insecticides we will also investigate the possibility of season long control of these pests with fungal biopesticides.

References

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