COMPARATIVE PATHOGENICITY TO ARGENTINE STEM WEEVIL OF *BEAUVERIA BASSIANA* FROM VARIOUS HOSTS

G.M. BARKER, H.H. GOH, S.N. LYONS and P.J. ADDISON

Ruakura Agricultural Centre, Private Bag, Hamilton

Keywords: biological control, entomopathogen, *Beauveria bassiana*, Argentine stem weevil, *Listronotus bonariensis*

Argentine stem weevil (ASW) (*Listronotus bonariensis* (Kuschel)) is an important pest in pastures throughout New Zealand. The entomopathogenic fungus, *Beauveria bassiana* (Bals.) Vuillemin, causes epizootic density-dependent mortality in overwintering Waikato populations of adult ASW (Barker *et al* 1989). *B. bassiana* is currently being investigated as a candidate biological insecticide for control of ASW (Barker *et al* 1991; Goh *et al* 1991).

This paper describes a laboratory assessment of the pathogenicity to adult ASW of *B. bassiana* isolated from various insect hosts.

B. bassiana was isolated from ASW, wasps (*Vespula* spp.), black vine weevil (*Otiorhynchus sulcatus* (F.)), sitona weevil (*Sitona discoideus* Gyllenhal), black beetle (*Heteronychus arator* (F.)), and hoverfly (*Syrphus novaezealandiae* Macquart) and maintained in cultures on potato dextrose agar. Approximately 1 g of conidia from each was suspended in 10 ml of 0.5% Tween 80 by vigorous agitation and then diluted in 0.5% Tween 80 to give 1×10^6 conidia/ml. Sixty weevils collected from Waikato pastures were placed in the conidial suspension, and agitated for 30 seconds. Ten weevils were then placed in each of six replicate Petri dishes lined with moistened filter paper. Sixty similarly handled uninoculated weevils were agitated for 30 seconds in 0.5% Tween 80 solution. Weevils were supplied with fresh leaf segments of ryegrass (*Lolium multiflorum* L.) cv. Concord at 2 to 4 day intervals.

Three replicates were incubated at 15°C, and three at 25°C. To maintain 100% relative humidity, all Petri dishes were held in vessels which enclosed an open body of water. Numbers of dead weevils were recorded at 2 to 4 day intervals. At each assessment, dead weevils were removed from the Petri dishes. The proportions of weevils dead in the *B. bassiana* treatments were corrected for mortality in untreated (which never exceeded 0.3) using Abbott's formula and then analysed by generalised linear regression using a binomial distribution with logit link.

Proportional mortalities in inoculated weevils were significantly affected by isolate, temperature and isolate x temperature interactions (Table 1). Fungus-induced mortality was higher at 25°C than at 15°C (day 14, $P < 0.001$; day 20, $P < 0.05$), with the exception of one isolate from wasp (W4) which was more pathogenic at 15°C (interaction, $P < 0.05$).

All *B. bassiana* isolates from ASW effected high mortality in this host by day 20. However, earlier assessments indicated that the rate at which inoculated weevils died varied significantly between isolates ($P < 0.01$).

B. bassiana isolates from black vine weevil (F9), sitona weevil (F13) and hoverfly (D1) effected mortality similar to that of the isolates from ASW. In contrast, isolates from wasps and black beetle induced significantly lower mortality in the weevils ($P < 0.001$).

High virulence is one requirement of an entomopathogenic fungus if it is to be successfully employed as a biological insecticide (May and Hassell 1988; Payne 1988). The present study clearly indicates that isolates of *B. bassiana* from various hosts differ in their pathogenicity to ASW adults. Isolates of superior pathogenicity to Argentine stem weevil can therefore be selected by simple screening techniques as described here.

Proc. 44th N.Z. Weed and Pest Control Conf. 1991: 214-215

TABLE 1: Cumulative mortality of adult Argentine stem weevil after topical application with *Beauveria bassiana* isolates.

Isolate ¹	Proportion of weevils dead (standard error)					
	15 °C			25 °C		
	Day 9	Day 14	Day 20	Day 6	Day 14	Day 20
1 ASW 4	0.13 (0.07)	0.63 (0.10)	0.95 (0.04)	0.53 (0.11)	0.96 (0.04)	1.00
2 ASW 5	0.25 (0.12)	0.54 (0.11)	0.80 (0.08)	0.47 (0.11)	1.00	1.00
3 ASW 7	0	0.32 (0.11)	0.60 (0.10)	0.10 (0.07)	0.89 (0.07)	1.00
4 ASW 12	0	0.27 (0.11)	0.75 (0.09)	0.30 (0.10)	0.85 (0.08)	1.00
5 ASW 17	0.07 (0.04)	0.50 (0.11)	1.00	0.23 (0.09)	0.96 (0.04)	1.00
6 W 1	0	0	0	0.03 (0.04)	0.03 (0.03)	0.03 (0.03)
7 W 2	0	0.04 (0.04)	0.40 (0.12)	0	0.33 (0.11)	0.43 (0.12)
8 W 3	0.07 (0.07)	0.07 (0.07)	0.35 (0.12)	0.07 (0.05)	0.30 (0.11)	0.33 (0.12)
9 W 4	0	0.18 (0.11)	0.70 (0.09)	0	0.07 (0.07)	0.07 (0.07)
10 F 9	0.07 (0.07)	0.63 (0.10)	0.90 (0.06)	0.20 (0.09)	0.84 (0.08)	0.90 (0.06)
11 F 13	0.07 (0.04)	0.68 (0.10)	0.85 (0.07)	0.23 (0.09)	0.78 (0.09)	0.95 (0.04)
12 BB 1	0	0	0.35 (0.12)	0	0.44 (0.11)	0.56 (0.08)
13 BB 2	0	0.09 (0.11)	0.20 (0.12)	0.10 (0.11)	0.56 (0.11)	0.71 (0.09)
14 D 1	0.07 (0.07)	0.45 (0.11)	0.75 (0.09)	0.43 (0.11)	0.92 (0.05)	1.00

¹Sources of isolates: 1-4 ASW, Hamilton; 5 ASW, Lincoln; 6 & 7 Wasp, Hamilton; 8 Wasp, Matamata; 9 Wasp, Te Poi; 10 Black vine weevil, Lincoln; 11 Sitona weevil, Lincoln; 12 & 13 Black beetle, Hamilton; 14 Hover fly, Hamilton.

Furthermore, the results of this and companion studies (Goh *et al* 1991) indicate potential for selection of isolates that are highly pathogenic at 15 °C. This is likely to be a requirement for successful application of *B. bassiana* against ASW in the field in spring-early summer.

These results confirm other studies (Goh *et al* 1991) showing that *B. bassiana* infecting ASW in the Waikato comprises strains heterogeneous in their pathogenicity to this host. ASW densities in pastures vary throughout the year and there are many alternative insect hosts which may enable frequent host-switching by *B. bassiana*. Consequently there may be little coevolution occurring between ASW and this pathogen, which in turn may be responsible for maintenance of high virulence in this host.

ACKNOWLEDGEMENTS

We thank A.C. Firth for technical assistance, B.W. Dow for statistical assistance, and Dr T. Glare for isolates of *B. bassiana*.

REFERENCES

- Barker, G.M., Pottinger, R.P. and Addison, P.J., 1989. Population dynamics of the Argentine stem weevil (*Listronotus bonariensis*) in pastures of Waikato, New Zealand. *Agr. Ecosyst. and Environ.* 26: 79-115.
- Barker, G.M., Pottinger, R.P., Goh, H.H. and Goldson, S.L., 1991. Biological control of Argentine stem weevil. *Proc. Ruakura Farmers' Conf.* 43: 190-193.
- Goh, H.H., Barker, G.M., Addison, P.J., Lyons, S.N., and Firth, A.C., 1991. Comparative pathogenicity of *Beauveria bassiana* isolates to adult Argentine stem weevil in the laboratory. *Proc. 44th N.Z. Weed and Pest Control Conf.*: This issue.
- May, R.M. and Hassell, M.P., 1988. Population dynamics and biological control. *Phil Trans. Roy. Soc. Lond. B* 318: 129-169.
- Payne, C.C., 1988. Pathogens for the control of insects: where next? *Phil. Trans. Roy. Soc. Lond. B* 318: 225-248.