Beauveria bassiana activity against *Lygus hesperus* at low temperatures

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Justification and Problem Statement

The Western tarnished plant bug, *Lygus hesperus*, is a key pest of cotton in western production regions, including the San Joaquin Valley of California. Development of improved and ecologically benign management tactics for *Lygus* represents a major component of the overall mission of the Western Integrated Cropping Systems Research Unit. *Beauveria bassiana* is a naturally-occurring fungus that routinely attacks *Lygus* in the San Joaquin Valley (McGuire 2002). Previous research within the Unit sought to select for strains, or isolates, of *Beauveria* that were effective under high summertime temperatures typical of the region (McGuire et al. 2005). Despite identification of *Beauveria* isolates with activity at high temperatures, field studies indicated less impact on *Lygus* population levels than was expected at the infection levels observed (Leland et al. 2005, McGuire and Leland 2006). Therefore, the use of *Beauveria* as a rescue treatment in commercial cotton is of questionable value.

Effective management of *Lygus* in cotton is complicated by the mobility of the pest, which moves among numerous cultivated and non-cultivated host plants, and by the difficulties associated with precise population estimation. An ecologically-based approach to *Lygus* management utilizing naturally-occurring pathogens is conceptually attractive, but the most appropriate use of such materials may not be as rescue treatments. In other words, the pathogens may be more effectively utilized during the non-cotton season, when environmental conditions are conducive to achieving and maintaining high levels of infection. In that case, the management objective would be to reduce population levels of overwintering *Lygus* on non-cotton hosts, thereby reducing the potential for subsequent infestation of cotton by damaging *Lygus* populations. Development of such a management tactic would require increased knowledge of the dynamics of *Lygus* diapause and overwintering ecology, and identification of *Beauveria* isolates that are effective under cool, wintertime conditions. Our objectives were to conduct preliminary trials to evaluate the activity of selected *Beauveria* isolates under low temperature conditions.

Procedures

All assays used mixed-sex, 1- to 3-d-old *Lygus hesperus* adults obtained from a laboratory colony maintained on green beans and raw sunflower seeds. Immediately before *Beauveria* application, groups of 10 adult *Lygus* contained in a Petri plate were anesthetized with CO_2. The plate was then placed within a specially-designed spray chamber, where it was sprayed with 5 ml of a suspension of *Beauveria* spores. Concentrations of spores ranged among assays from about 5.6×10^6 to 1×10^7 spores/ml. After spore application, bugs were placed in individual vials, each containing a section of green bean. Vials were held in environmental chambers set to maintain the desired temperatures. *Lygus* bugs were examined daily for mortality, and in initial trials dead bugs were also examined for sporulation (which indicated mortality was likely caused by *Beauveria* infection).

Initial trials using temperatures of 23.9, 18.3, and 12.8°C (75, 65, and 55°F) focused on confirming *Beauveria* infection under low temperatures, and on determining appropriate time frames for the assays. Three separate trials incorporated one or more of isolates s44, 38-06, 56-06, 17-41, and GHA (the commercially available isolate, Mycotrol, Emerald BioAgriculture, Lansing, MI).

A pair of subsequent trials used only the lower two temperatures (18.3 and 12.8°C) and evaluated the efficacy of nine isolates, which were selected on the basis of performance under low temperatures in previous radial-growth assays. The isolates tested in the first assay included GHA, 54-43, 17-41, s44, ni9, ni8, ni6, ni1, and 3769. The second assay used the same isolates as the first, except that isolate 56-06 was substituted for isolate 54-43.

Mortality curves of *Beauveria* isolates, and curves corresponding to different temperatures within isolates, were examined for differences using the SAS procedure PROC LIFETEST (SAS Institute 2002).

Results and Discussion

Preliminary assays of limited numbers of *Beauveria* isolates indicated 1) high levels of infection could be achieved at temperatures as low as 12.8°C, and 2) that appropriate time intervals for assessing mortality were approximately 14, 21, and 28 d for temperatures of 23.9, 18.3, and 12.8°C, respectively. In these assays, mortality observed in the *Beauveria*-treated bugs was always higher than for the untreated controls.

Results of the two assays incorporating larger numbers of *Beauveria* isolates also indicated differences in survival between *Beauveria*-treated and untreated bugs. In addition, differences in mortality among *Beauveria* isolates were observed at 18.3°C in the first assay, when isolates s44 and 54-43 appeared to provide mortality more slowly than did other isolates. No differences among isolates were observed at 12.8°C in the first assay, or at either temperature in the second assay.

When activity of the isolates was examined relative to temperature, mortality occurred sooner at 18.3 than at 12.8°C for 16 of the 18 isolates examined. Representative data corresponding to two of the better performing isolates (s44, 56-06) and the commercial isolate (GHA) are illustrated in Figs. 1 and 2.

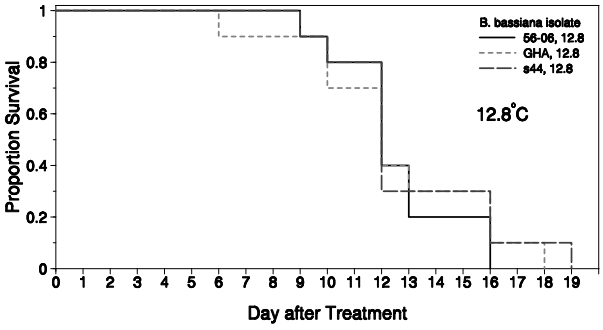

Fig. 1. Mortality of *Lygus hesperus* exposed to three *Beauveria bassiana* isolates at 12.8°C.

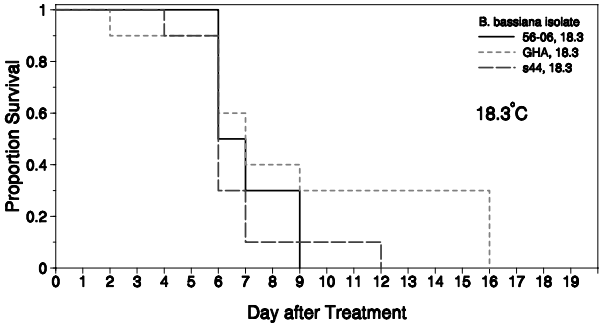

Fig. 2. Mortality of *Lygus hesperus* exposed to three *Beauveria bassiana* isolates at 18.3°C.

Observed mortality of *Lygus* adults under low temperature conditions suggests continued investigation of a tactic incorporating treatment of overwintering quarters or hosts with *Beauveria* may have merit. These results not only provide the rationale for more extensive screening efforts, but also illustrate the need for additional information regarding the sites and mechanisms involved in *Lygus* overwintering in the San Joaquin Valley.

References

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