

# Temperature and Humidity Interactions of *Beauveria bassiana* and Diatomaceous Earth for Control of the Lesser Grain Borer, *Rhyzopertha dominica*: An Unexpected Increase in Fungal Efficacy with Low Moisture

## Materials and Procedures

Unformulated *Beauveria bassiana* isolate GHA conidia (Emerald, Butte, MT) and diatomaceous with 10% silica gel (Protect-It, Hedley, Blaine, WA) were mixed into moisture-equilibrated wheat at 200 and 100 mg/kg, respectively.

Assays of progeny survival under various temperature-humidity regimes were carried out through the termination of emergence. Ten parental females were used in each of three replicates carried out over time.

The assay of humidity effects on adult mortality with fungus was assessed after 8 days of incubation. There were three replicates of 20 beetles.

The assay of RH effects on survival from egg to emergence with fungus was incubated for 5-6 weeks from hatch. There were three replicates of 20 eggs.

Germination rates of 100 conidia for each of three replicates incubated on wheat or glass were taken at 18 and 42 hours after plating on Sabouraud dextrose agar.

Humidities were maintained by incubation over saturated salt solutions.

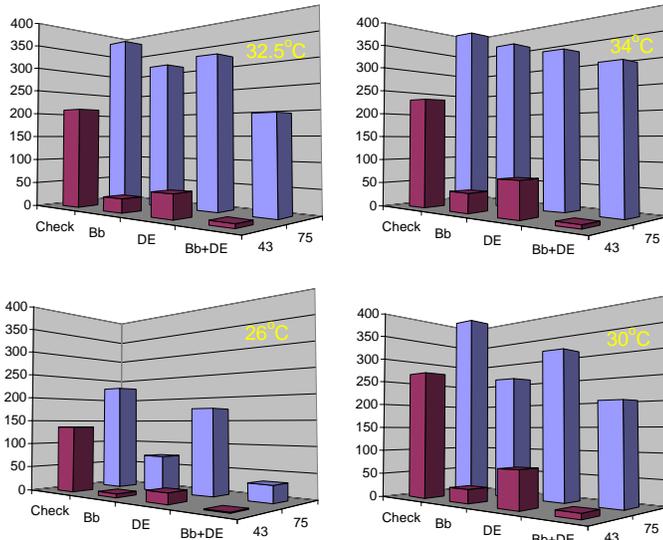


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A prevailing belief about entomogenous fungi is that their efficacies are inexorably linked to elevated ambient humidity. However, there is abundant published evidence indicates that the interaction of entomogenous fungi with ambient humidity depends on strain, host, and environment. Desiccant dusts have been shown to synergize *Beauveria bassiana*'s effect on *Rhyzopertha dominica* under our standard assay conditions. This study was conducted to: 1. determine the effects of *B. bassiana* and diatomaceous earth through a range of conditions 2. assess the fungus' impact on adult and larval beetles 3. determine the longevity of inoculum under various temperature and moisture conditions and on wheat as a substrate.

Results: Adult progeny of female lesser grain borers introduced into wheat that was treated with *B. bassiana*, diatomaceous earth, or both.

- There were less surviving progeny in all treatments including controls at 43% RH than at 75% RH.
- The percentage reduction as compared with controls was greater at 43% RH than at 75% RH. (Bottom table)
- Progeny reduction with *B. bassiana* alone decreased with increasing temperature.

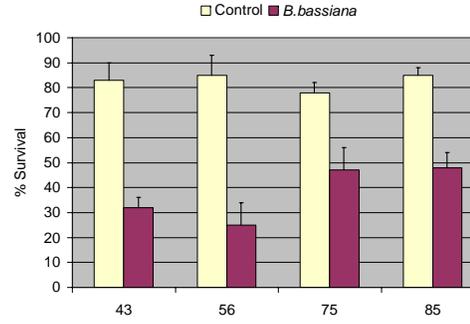


	26°C		30°C		32.5°C		34°C	
	43%	75%	43%	75%	43%	75%	43%	75%
<i>B. bassiana</i>	94.3	67.5	89.5	37.2	86.7	18.2	83.0	10.8
DE	84.5	23.1	89.5	24.9	77.4	15.5	68.9	17.4
<i>B. bassiana</i> +DE	98.8	85.2	89.5	51.0	96.1	48.1	96.9	26.2

% Reduction

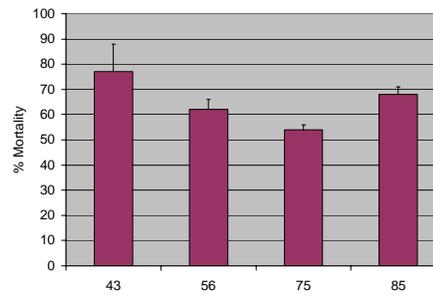
Results: Lesser grain borer survival from egg to adult in wheat treated 200 mg of *B. bassiana*/kg at 30°C and 4 moisture levels

- Survival in the presence of *B. bassiana* was lower at the lower two than at the higher two humidities.



Results: Adult mortality after 8 days of incubation in *B. bassiana*-treated wheat at four relative humidities and 30°C (No control mortality)

- Mortality was greatest at the lowest and highest moisture levels.



## Conclusions

- At 43% RH, a moisture level that is stressful to *R. dominica*, *B. bassiana* was more efficacious than it was at higher moisture levels.
- *B. bassiana* was more efficacious than at the lower temperatures.
- Diatomaceous earth is more efficacious with low moisture and enhances *B. bassiana*'s efficacy. (≥ 96% reduction in survival of progeny at 43% RH)
- Conidial survival is negatively affected by wheat, but positively affected by reduced moisture.

Results: Longevity of *B. bassiana* conidia on wheat kernels or glass when incubated at 30°C and 4 moisture levels.

- Wheat had a negative impact on conidial survival.
- Longevity correlated inversely with moisture level.
- Survival of slow-germinating conidia was revealed by extended incubation (allowed by inclusion of benomyl in the agar)
- After several weeks at 85% RH, contaminant fungi on wheat obscured results.

