



## Research Experiences for Undergraduates (REU) 2012

### Abstract

**HALL, F., WELCH, J., WOODARD, D., GWINN, K., PROTOPOPESCU, V., RYAN, D., and W. LIU.** Effects of Constituent Monoterpenes of *Monarda* on Sporulation and Germ Tube Growth of *Beauveria bassiana*. National Institute of Mathematical and Biological Synthesis, Knoxville, TN, Department of Biology, Earlham College, Richmond, IN, Department of Mathematics, University of Tennessee, Knoxville, TN, Department of Mathematics, Appalachian State University, Boone, NC, Department of Entomology and Plant Pathology, University of Tennessee, Knoxville, TN, Oak Ridge National Laboratory, Oak Ridge, TN.

According to previous research, both essential oils of various *Monarda* species and spores of *Beauveria bassiana* fungus, when applied to tomato plants prevent certain kinds of pathogens. However, oils are highly volatile and degrade within weeks. Conversely, at room temperature the fungus spores take weeks to germinate. The goal of this study was to test the viability of combining both of these forms of biocontrol in a single plant in order to offer a complete pesticide alternative. To this end *B. bassiana* spores were exposed to treatments of five different concentrations of the vapors of first individual constituent monoterpenes: geraniol, cymene, carvacrol, thymol, and borneol, then to various ratios of combinations at concentration 0.5  $\mu\text{M}$  of thymol and cymene, and finally to the same of thymol and geraniol. Spore length was measured on 200 randomly selected microscope shots in the first two experiments, and spore length of the first 100 germinated located under the microscope in the final case. The data was sorted into histograms and parameterized and then AIC values were calculated for the possible distribution fits. Across all experiments the entire data set was best fit with generalized Pareto distributions while the germinated data set was best fit with lognormal distributions. In all cases, attempts to find a mathematical relationship between parameters and concentration were inconclusive. More conclusively, ANOVAs indicate a limited inhibition of *B. bassiana* by all of the constituent monoterpenes at lower concentrations and also no significant difference between any of the single essential oil treatments. Further research is necessary to both develop a better model and to further investigate the possibility of employing these biocontrol methods as an alternative to chemical pesticides.