

Intraspecific Competition in Bean Beetles

Objectives

1. Evaluate characteristics of female bean beetles, *Callosobruchus maculatus*, egg laying (oviposition) patterns.
2. Design and perform an experiment to evaluate whether competition is occurring between females as they lay eggs on beans, and whether competition is occurring between larvae in individual beans.

Introduction

Bean beetles (cowpea seed beetles), *Callosobruchus maculatus*, are agricultural pest insects of Africa and Asia. Females lay their eggs on the surface of beans (Family Fabaceae). Eggs are deposited (=oviposition) singly and several days after oviposition, a beetle larva (maggot) burrows into the bean. At 30°C, pupation and emergence of an adult beetle occurs 25-30 days after an egg was deposited. Adults are mature 24 - 36 hours after emergence and they do not need to feed. Adults may live for 7-10 days during which time mating and oviposition occur. Since larvae cannot move from the bean on which an egg was deposited, the oviposition choice of a female determines the future food resources available to their offspring. The choice of prey bean is the most critical choice a female makes for her offspring, as it will influence their growth, survival, and future reproduction (Mitchell, 1975; Wasserman and Futuyma, 1981).

Experimental Design

Since the oviposition choices of females influence the survival and future success of their offspring, females may be very sensitive to the presence of potential competitors in (and on) the beans on which they are depositing eggs. Address the following questions. Come to class ready to discuss your answers.

- In bean beetle populations, who are potential competitors of a female's offspring? Do female bean beetles attempt to minimize competition among their offspring? Design an experiment or set of experiments to test the hypothesis that females will attempt to minimize competition.
- The hypothesis that females will attempt to minimize competition is based on what underlying assumption? Design an experiment or set of experiments to test this assumption.

For each of the experiments you designed above, you should:

- predict the possible outcomes for the experiment that would support your hypothesis
- identify and list the variables you would manipulate in your experiment
- identify and list the variables you would keep constant in your experiment
- list the data you would collect to determine if your predictions were true

Literature Cited

Brown, L. and J.F. Downhower. 1988. *Analyses in Behavioral Ecology: A Manual of Lab and Field*. Sinauer Associates, 194 pages.

Mitchell, R. 1975. The evolution of oviposition tactics in the bean weevil, *Callosobruchus maculatus* F. *Ecology* 56:696-702.

Wasserman, S.S. and D.J. Futuyma. 1981. Evolution of host plant utilization in laboratory populations of the southern cowpea weevil, *Callosobruchus maculatus* Fabrivius (Coleoptera: Bruchidae). *Evolution* 35:605-617.

This experiment was written by C. Beck and L. Blumer (www.beanbeetles.org).