

Cost of Reproduction in Bean Beetles

Student Handout

Objectives

- To identify factors in the reproductive cycle of a bean beetle that are potentially energy costly
- To design and execute an experiment to test which factors are most energetically costly for the bean beetle

Introduction

The principle of allocation states that life histories of organisms are based on a series of trade-offs designed to maximize the overall fitness of an individual. In other words, if organisms use energy for one function such as reproduction than the amount of energy available for other functions is reduced (Cody 1966). In juveniles of a species, energy is divided between survival (for example, obtaining nutrients, escaping from predators, dealing with environmental changes) and growth. Once the organism has reached sexual maturity however, those same energy resources are now divided among survival, growth and reproduction. For many organisms, the cost of reproduction comes in the form of reduced longevity (Yanagi and Miyatake 2003, Paukku and Kotiaho 2005). In this lab, you will examine how different reproductive costs influence the life span of the bean beetle, *Callosobruchus maculatus*. Bean beetles are ideal organisms for examining reproductive costs because they only feed during the larval stage. This lack of feeding as an adult means that the beetle has a finite amount of energy resources to draw on as it completes its lifecycle.

Materials

In class you will be provided with live bean beetle cultures that have been raised on mung beans. These cultures will be used to help you practice identify the sexes. You also will be provided with cultures on mung beans and black eyed peas that contain beetles which have not yet emerged. Your instructor will show you how to recognize beans that have started to form “windows” indicating that a beetle will emerge within the next few days. These beans can then be placed into individual wells in 6 or 12 well plates in order to isolated virgin individuals to use in your experiment. Petri dishes will also be provided to use as housing during the actual experiment.

Experimental Design

Prior to lab review the bean beetle handbook (<http://www.beanbeetles.org/handbook>) to become familiar with your organism.

1. What costs do you think a beetle might incur in the reproduction process?
2. Do these costs differ by sex?

3. How can you measure the cost of each of these processes (i.e. what data will you collect? hint: review your bean beetle lifecycle)?
4. Are there other environmental factors that might influence the amount of resources available for reproduction that need to be considered?

As a group decide on a question that you would like to ask regarding the costs of reproduction in bean beetles, formulate a hypothesis and design an experiment to test your hypothesis.

Literature Cited

Cody, M.L. 1966. A general theory of clutch size. *Evolution* 20:174-84.

Paukku, S. and J. Kotiaho. 2005. Cost of reproduction in *Callosobruchus maculatus*: effects of mating on male longevity and the effect of male mating status on female longevity. *Journal of Insect Physiology* 51:1220-6

Yanagi, S. and T. Miyatake. 2003. Costs of mating and egg production in female *Callosobruchus chinensis*. *Journal of Insect Physiology* 49:823-27.