Comparing the effects of protein supplement vs. natural forage on colonies used in almond pollination

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Purpose of Research

Before colonies are placed in orchards for almond pollination, they often are kept in holding yards. The colonies are fed protein and carbohydrate supplements because flowering plants are unavailable. Under these conditions, colony populations can decline so that they no longer are of suitable strength for pollination. In other instances, the colonies die from malnutrition and disease.

Supplemental protein diets can sustain colonies and stimulate brood rearing. However, the benefits on colony health might diminish over time especially if the diets do not provide all the nutrients bees need to rear brood or optimize adult bee longevity. Plants that are attractive to bees and can be grown in the late fall and winter could be an alternative to supplemental protein feeding. Growing plants rather than feeding pollen supplements in the winter is a departure from current beekeeping practices. Data are needed to demonstrate if there is indeed justification for spending resources on plantings rather than on purchasing feed. A plant that blooms in the winter in the southwest and southern California and might supply forage is rapini (*Brassica rapa*).

The proposed study will provide fundamental information on the nutritional value of rapini, and how it compares with two commonly used protein supplement diets. We will feed full sized colonies protein supplements during the late fall and winter in areas without blooming plants. Other colonies will be placed near fields with blooming rapini. Data also will be collected from 5-frame nucleus colonies fed protein supplements or exposed to blooming rapini plants in our enclosed flight area. We will measure protein and amino acid availability in the diets and rapini pollen and determine the acquisition of those nutrients by the bees. We also will determine how diet source affects immunity, brood rearing and colony growth. If rapini plantings are an improvement over protein supplements, we should see significantly larger colonies in February that have the potential to cross-pollinate and set more almond blossoms

Objectives:

Objectives 1. Determine nutritional quality of pollen from rapini (*Brassica rapa*) flowers and the bee bread made from it and compare this with the protein supplement diets.

Objective 2. Compare hemolymph protein concentrations of nurse bees from colonies foraging on rapini and those feeding on a protein supplement diet.

Objective 3. Compare brood production between colonies foraging on rapini and those feeding on a protein supplement diet.

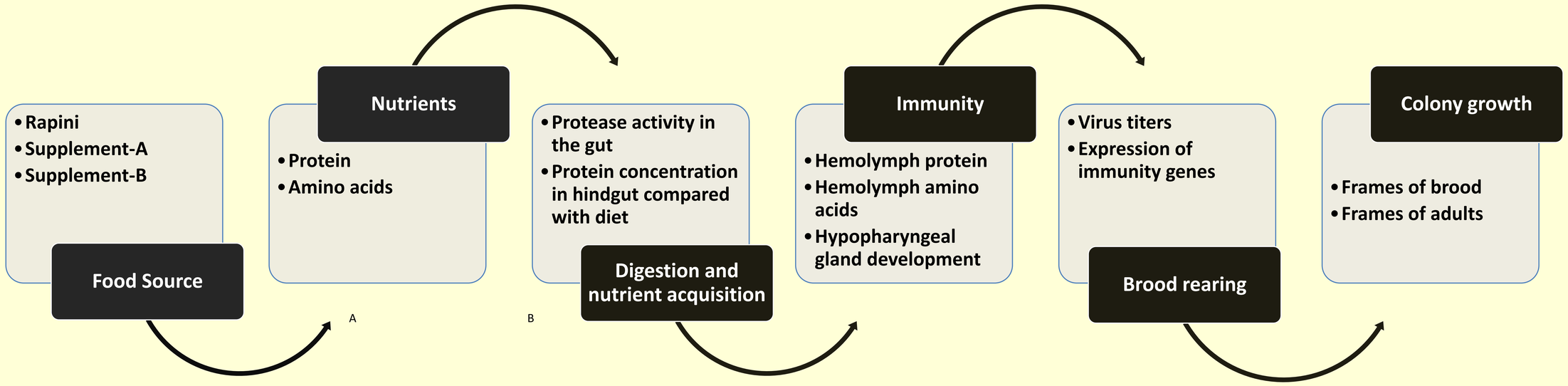
Objective 4. Compare virus titers and expression levels of vitellogenin (Vg) and genes in SII and mTOR pathways in nurse bees and larvae collected from colonies fed protein supplement or foraging on rapini.

Protein diet-1

Protein diet-2

Rapini florets

Logical flow for data collection



Potential Benefits to Almond Growers of pre-Bloom Nutrition