Assessing the value of supplemental forage for honey bees during almond pollination

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Introduction

Honey bee colonies employed for almond pollination face two challenges with respect to nutrition:

a) lack of adequate foraging resources before and after almond bloom
b) lack of floral diversity during almond bloom.

Almond orchard with no vegetative understory
Photo: OSU Honey Bee Lab

To address this nutritional stress, organizations such as Project Apis m. are providing alternate forage for bees before and after almond bloom in California. To successfully implement and promote this strategy we need to understand the potential of these supplemental bee forages in promoting honey bee colony health. We measured honey bee colony health and nutrition in colonies adjacent and at a distance from supplemental forage.

Objective

Our objective was to evaluate the nutritional value of supplemental forage prior to and after almond bloom on honey bee nutrition, colony growth, immune system and survival. We also evaluated honey bee foraging behavior by analyzing pollen trap catches.

Mustard planted adjacent to almond orchard, Orland, CA.
Photo: OSU Honey Bee Lab

Methods

Field sites:
We identified 6 field sites: 3 treatments (alternative forage) and 3 controls (no alternative forage available) near locations as indicated on the map below. Northern California treatment sites were near planted mustard and Southern California treatments sites were near wildflower plots planted by UC Davis researchers.

Colony measurements
On February 12, February 21-23, and March 10-12, 2015, we measured each marked colony for comb area occupied by brood (eggs, larvae, and pupae), honey, pollen, and empty space. We also measured the area covered by adult bees on each frame to estimate bee population.

We collected a sample of 300 honey bees from the brood nest of each marked colony. Samples were stored on dry ice and transported to the lab for further analysis.

We also installed pollen traps at the entrances of marked colonies. Pollen was collected, sorted by color, then sent to UC Davis / Dr. Neal Williams for identification.

Installing pollen traps.

Collecting a sample of honey bees.

Lab analysis
Lab analysis of honey bee samples included *Varroa* mite counts, nosema spore counts, and hypopharyngeal gland protein content. Immunocompetence analysis is underway.

Results

University of California researchers, Kimiora Ward and Neal Williams, identified the pollen we trapped from treatment and control colonies (Table 1). The identification of the pollen trapped tells us which plants honey bees foraged on specific dates and the proportion of pollen trapped indicates foraging intensity on a specific plant species.

During peak almond bloom, honey bees focused their foraging efforts in the almonds. Alternative forage was clearly utilized as the almond bloom waned and concluded.

Wildflower	Site	Pollen	23 Feb	27 Feb	6 Mar	10 Mar
Far	MA	Almond	94	76	6	
		Wildflowe	3	9	42	
		mustard	0	7	6	
		Unknown	3	5	20	
		Weed	0	3	31	
Near	MW	Almond	72	58	0	0
		Wildflowe	7	15	8	23
		mustard	16	42	23	57
		Unknown	4	6	6	2
		Weed	1	9	66	18

Mustard			12 Feb	21 Feb	12 Mar
Far	HA	Almond	97	96	76
		mustard	0	0	14
		Unknown	3	4	86
		Weed	0	0	0
	KA	Almond	91	50	0
		mustard	1	48	91
		Unknown	8	3	12
		Weed	0	0	1
Near	KM	Almond	91	31	0
		mustard	0	66	64
		Unknown	10	8	36
		Weed	0	0	0
	PM	Almond	98	31	1
		mustard	3	73	83
		Unknown	4	6	77
		Weed	0	0	0

The pollen collection data demonstrate the ideal pollination scenario: honey bees focus on pollinating almond blossoms when in bloom with minimal distraction to other forage, and upon bloom conclusion, honey bees have continuous resources available to sustain their growing population.

Pest, disease, and nutritional analyses were less conclusive. Unusual weather patterns yielding excessive blooming weeds and the unexpectedly short almond bloom led to significant variability. Future, repeated studies on honey bee health and nutrition in the presence and absence of supplemental forage during almond pollination will ideally decrease variability caused by environmental effects.

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