

OBSERVATIONS OF  
HBS AND BOBS  
POLLINATING AN  
ALMOND ORCHARD

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# The Orchard

- Forty acres of almond trees
- Located in Turlock, CA
- Nonpareil, Aldrich, and Carmel



# The Honeybees (HBs)



- Two HB hives per acre
- Very strong (14 frame bees)
- HBs were intended to be the major pollinator in this orchard.

# Blue Orchard Bees (BOBs)



100 female cocoons per acre  
In 2 nests per acre

This presentation  
organizes around five  
bloom periods:

1. Pre-bloom
2. Early Bloom
3. Morning at Peak Bloom
4. Afternoon at Peak Bloom \*
5. Late Bloom\*

# 1a . Pre-bloom



HBs were strong and hungry.  
• Few plants are blooming.

# 1b. Pre-bloom



The BOBs were still in a cooler.

## 2a. Early Bloom

When the very first flowers  
open...



## 2b. Early Bloom

...to around 20% open  
flowers



## 2c. Early Bloom



- Many HBs in each tree.
- Loads of nectar and pollen



A photograph of an orchard. In the foreground, several trees with dark, textured bark and sparse green leaves are visible. In the background, a red tractor is parked on a dirt path, and more trees are visible under a bright sky. The overall scene is slightly hazy.

Often fungicide is applied at around 10% bloom.

It is possible to establish females in nests before the spray is applied.



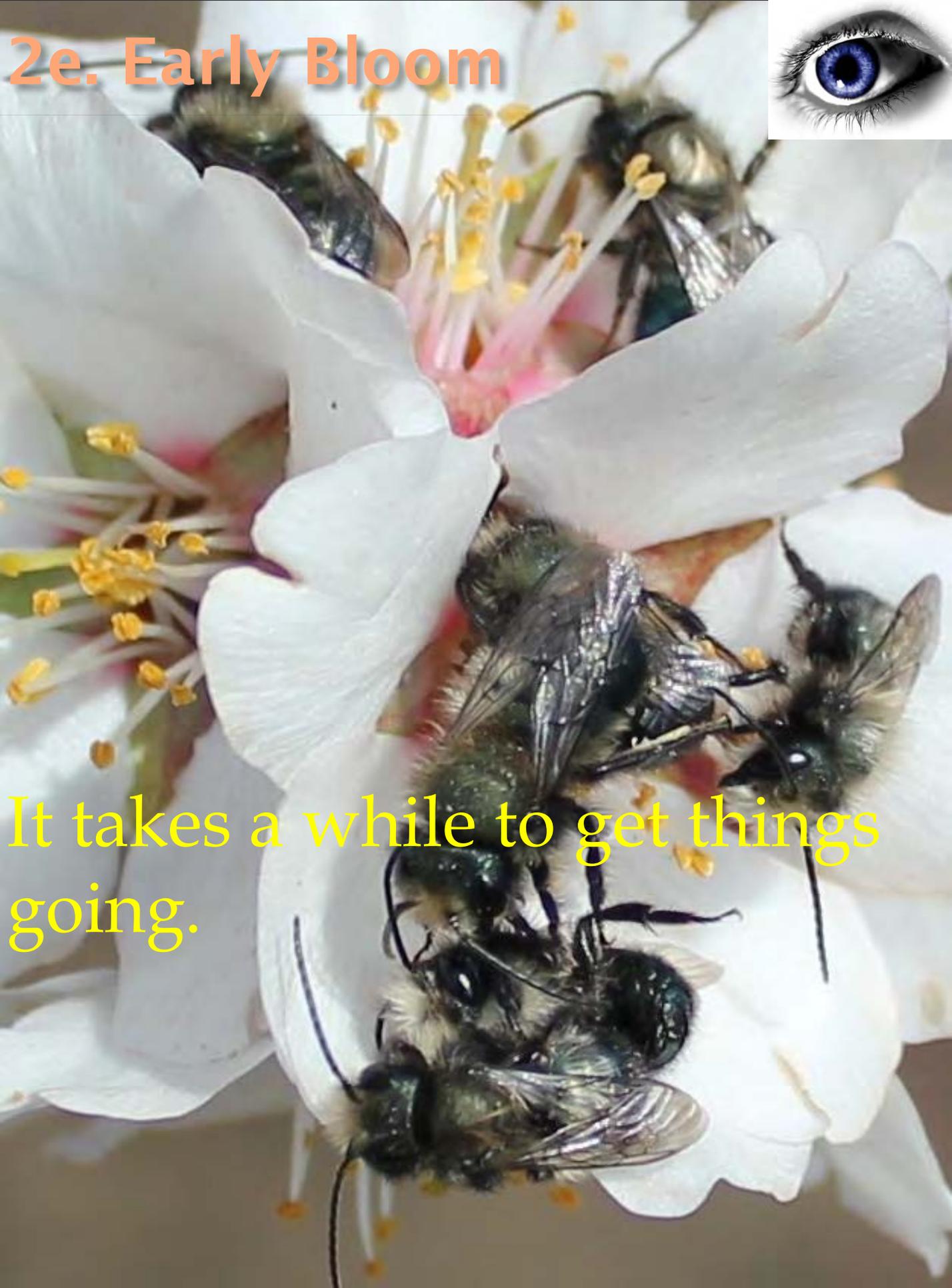
## 2d. Early Bloom

The BOBs were just emerging from cocoons and so were contributed little to making the crop.

## 2e. Early Bloom



It takes a while to get things going.





## 3a. Morning at Peak Bloom

The orchard contained thousands of trees and each tree held thousands of blossoms.



## 3b. Morning at Peak Bloom



There was lots of HB flight, with both pollen and nectar coming in.



## 3d. Morning at Peak Bloom



The BOB females were finally nesting and foraging.



4a. Afternoon at Peak Bloom

There were many HBs in the air...

but no pollen was going into the hives.

**“In almonds, pollen is shed early in the day and remains until the bees remove it, often by early afternoon if flight conditions are good. “**

**Written by HB researcher Eric Mussen and conveyed in an e-mail letter by David Doll.**

**“Nectar is secreted throughout the day, from more mature flowers that are not producing pollen much anymore, so nectar collecting bees may be in the orchards all day.”**

**Written by HB researcher Eric Mussen and conveyed in a 2011 e-mail letter sent by David Doll.**

**“My efficient foraging notion, I guess, is based on the little I know about HB colony information processing. An orchard has thousands of trees and each tree can have thousands of open flowers. I have believed that the colony, not the individual foragers, is directing the foraging and this involves processing overwhelming bits of data.”**

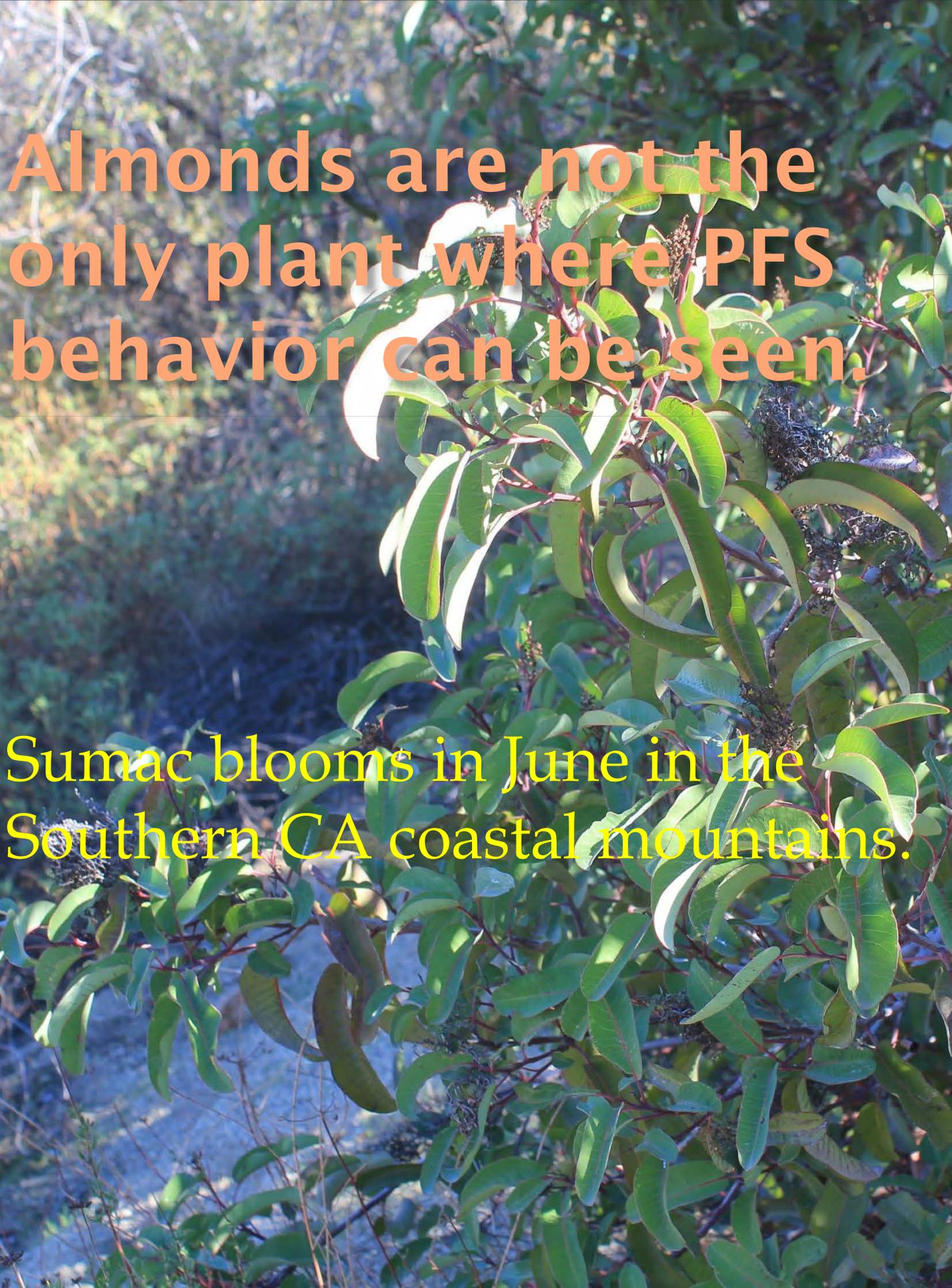
**Joe Trainer, HB broker, in an 2011 e-mail letter.**

**“As the day progresses the HBs return to the same tree and perhaps are repeating flower visits. Thus, I have assumed at some point the colony calls off the pollen foraging because it is more efficient to engage these foragers in nectar gathering. The existence of almond orchards of copious quantities of nectar is a significant factor behind this decision.”**

**Joe Trainer, HB broker, in an 2011 e-mail letter.**

## 4b. Afternoon at Peak Bloom

This HB behavior of suspending pollen foraging on a crop will be referred to as pollen foraging suspension (**PFS**).



Almonds are not the  
only plant where PFS  
behavior can be seen.

Sumac blooms in June in the  
Southern CA coastal mountains.



**Do HBs exhibit PFS behavior  
in other crops (apples, pears,  
and plums)?**

**This question is most easily  
answered in a monoculture  
setting where there are few other  
pollen sources.**



HB foragers gather either nectar or they gather pollen, but not both

What is this HB collecting?



Is this HB a pollen forager  
or a nectar forager?



This HB behavior is called *side-working*.

Nectar collectors often sidework, and when they do, very little cross-pollination occurs.



Nectar collectors spend a lot of time with jacket stage blossoms; which are past the reproductive stage, but secrete copious quantities of nectar.

4h. Afternoon at Peak Bloom



The BOBs continued to collect pollen during the afternoon.



## 5b. Late Bloom

There was heavy HB flight.  
Both pollen and nectar were coming in.

But there were few HBs in  
the orchard.



## 5c. Late Bloom



The HBs were thick in the neighboring orchard.

These Butte and Padre trees are late blooming. Now their dense set of open flowers was seducing the HBs away from the orchard.

To recap...

In this almond orchard BOBs worked side-by-side with HBs. The HBs played the major role and the BOBs filled in some of the cracks.



# Early-bloom

Many HBs were foraging.  
The BOBs were still  
establishing their nests.



# Morning at Peak Bloom

The BOB females were now also foraging.