

# Bees and Almonds: Protecting a Crop and Protecting the Pollinators



Gordon Wardell, PhD

Paramount Farming Company



**Almonds Should Be and Can Be  
the Safest Crop we Move Bees to.**

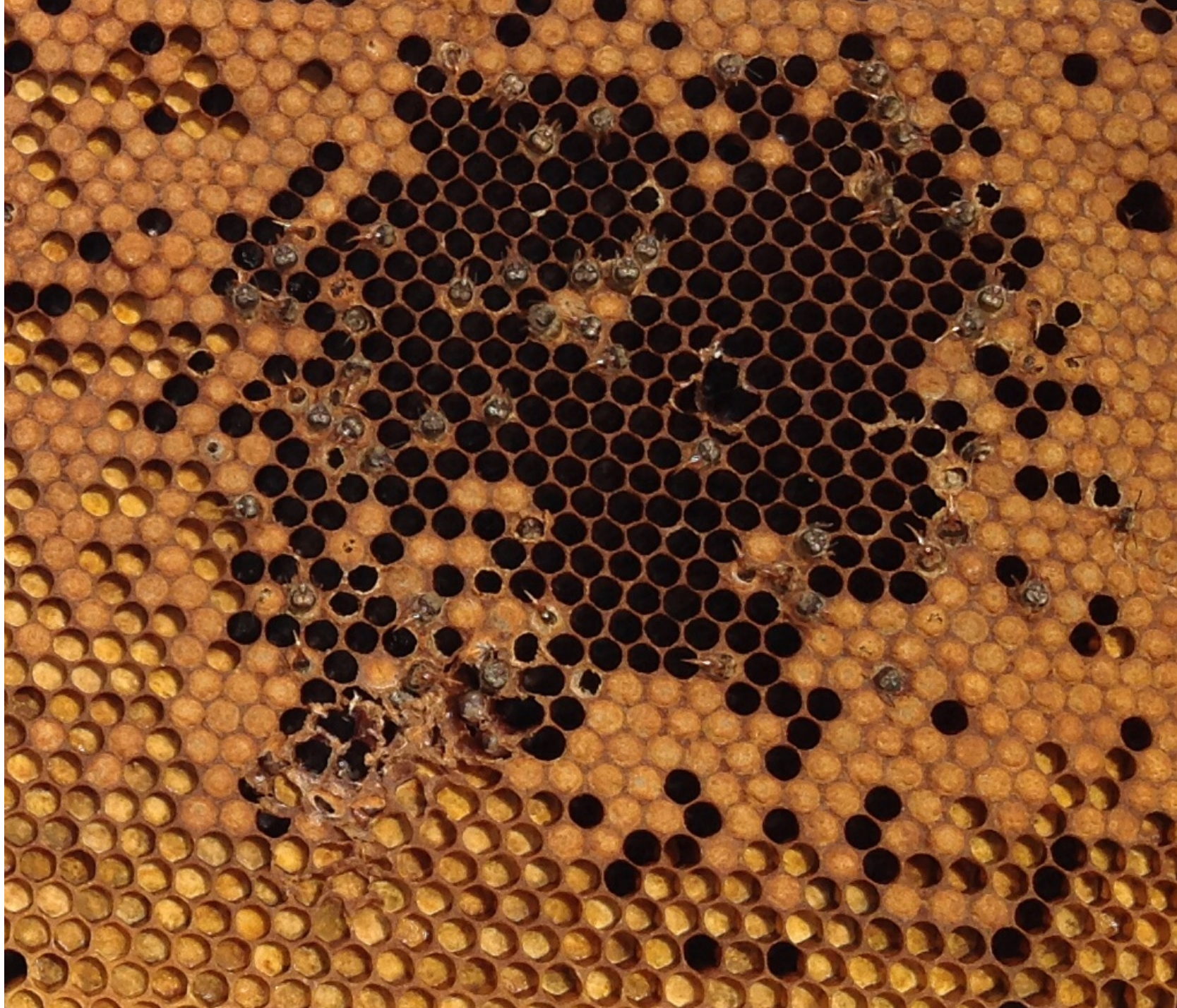
# Almond Facts

- 2014 – 860,000 acres of almonds in production
- Estimated yield – 2 billions pounds of almonds
- Greater than a 4 billion dollar crop
- Typically growers use two colonies per acre for adequate pollination
- 1,700,000 honey bee colonies are required to pollinate California's almond crop
- The average grower paid \$180/colony in 2014

# 2014 Almond Pollination Season

- One of the best pollination seasons on record, warm temperatures, good overlap between varieties, modest rain
- Unfortunately over 80,000 colonies were reported to have experienced spray damage during or immediately after bloom
  - Most were attributed to tank mixes with fungicides









Herbicide Bee Kill - Tank Mix:  
A generic roundup  
A second herbicide  
Spray Oil  
Liquid AMS (ammonium sulfate)

# Insect Plant Evolution



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# Honey Bee Basics



Honey Bees and  
Plants Evolved  
Together

# It Doesn't Have To Be An Either / Or



vs.



UGA0660061

We Can Protect the Crop and Protect the Bees

# **The four basic rules to follow to protect honey bees during the pollination season are:**

1. If it is necessary to spray the orchard, do so in the late afternoon or evening.
2. Until more is known through research, do not tank-mix products.
3. Avoid applying insecticides during bloom until more is known about the effects on honey bees.
4. Maintain clear communication among all parties involved.

# Daytime Applications: What's at Risk



- Daytime spray applications reduce potential yields!
  - Sprays harm foraging worker bees
  - Daytime sprays change the scent of the orchard and change foraging patterns
  - Sprays can potentially damage the stigmatic surface of the flower
  - If the brood population is damaged, the need for pollen in the colony is reduced and a percentage of bees will switch from pollen foraging to nectar foraging

# Honeybees' ability to find flowers could be hampered by a chemical in diesel exhaust, say scientists.

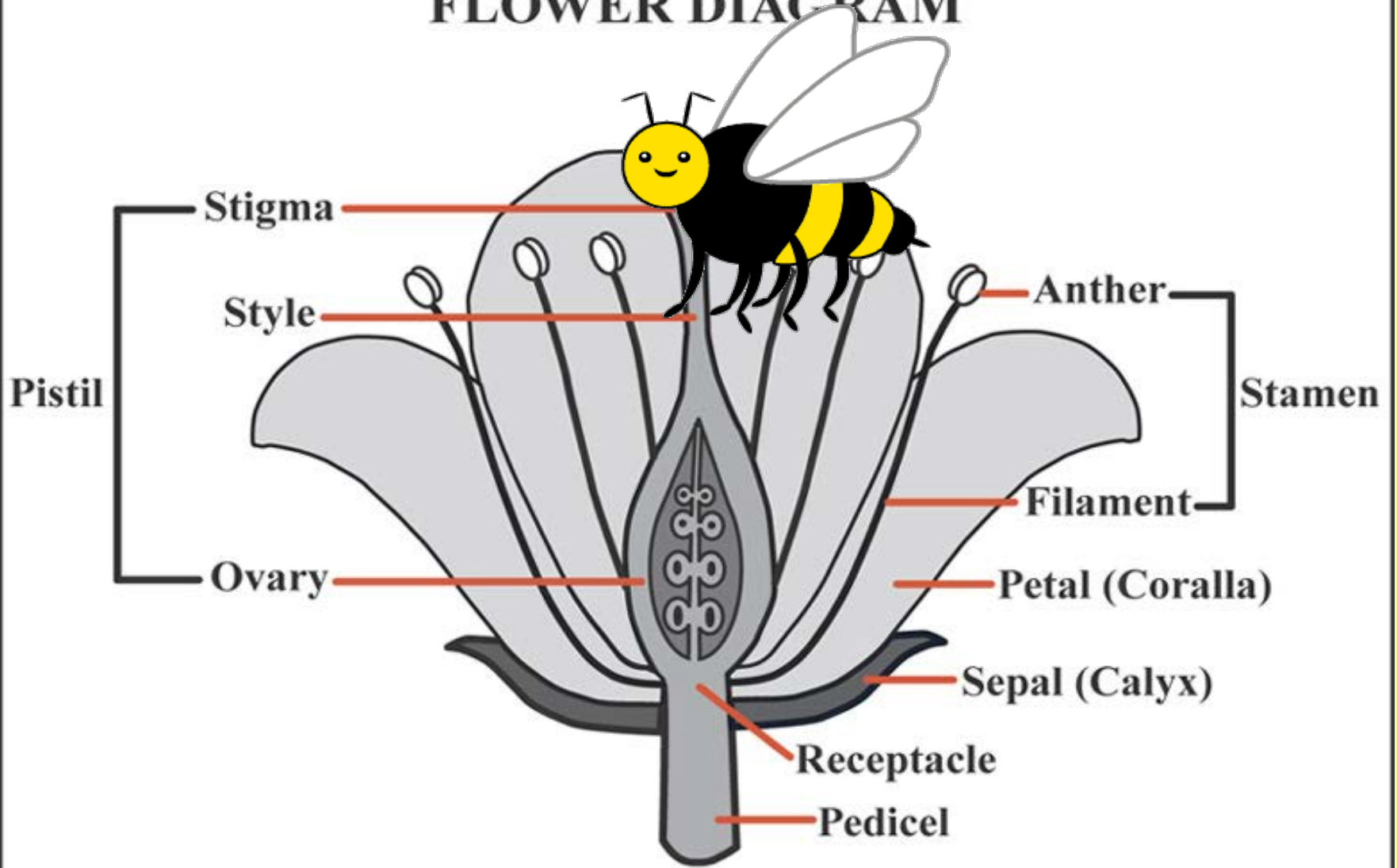
Tests showed that exhaust degraded some floral scent chemicals the bees "home in on" when they are foraging.

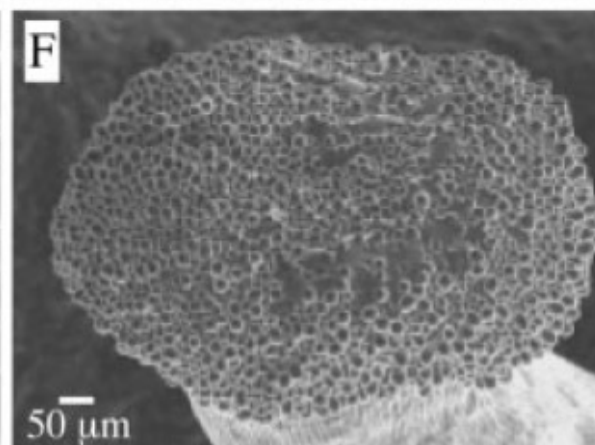
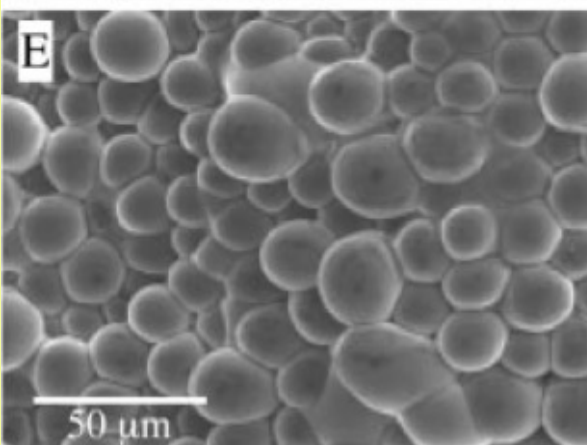
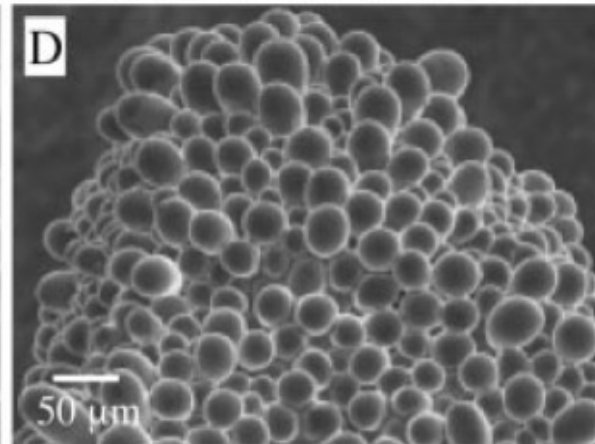
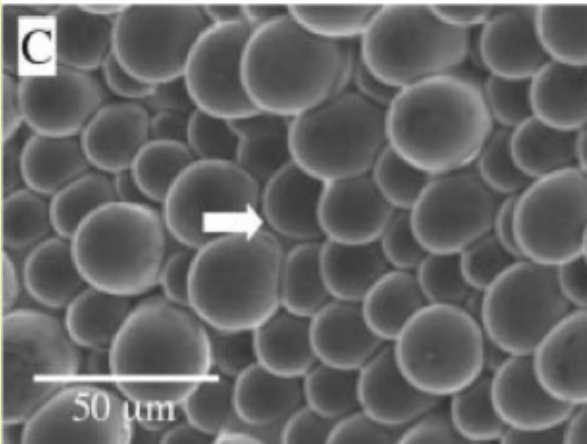
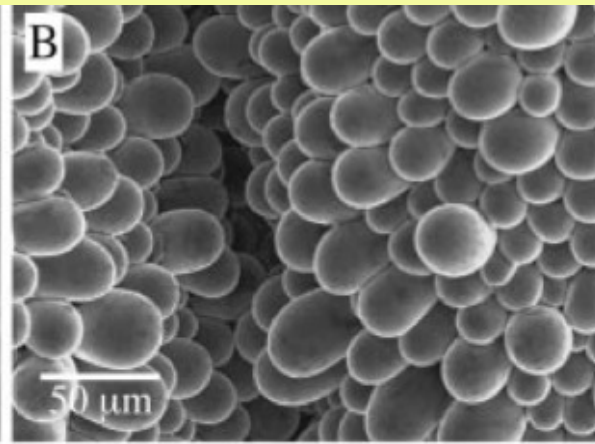
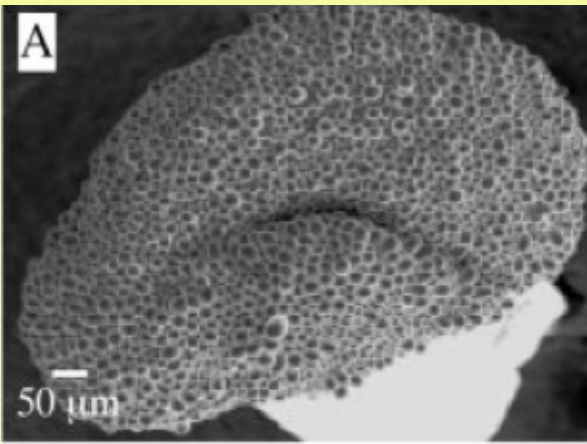
The study, published in Scientific Reports, also revealed that a specific group of chemicals found in diesel exhaust, known as NOx, diminished the insects' response to floral scents.

They say the results are evidence that air quality should be improved.

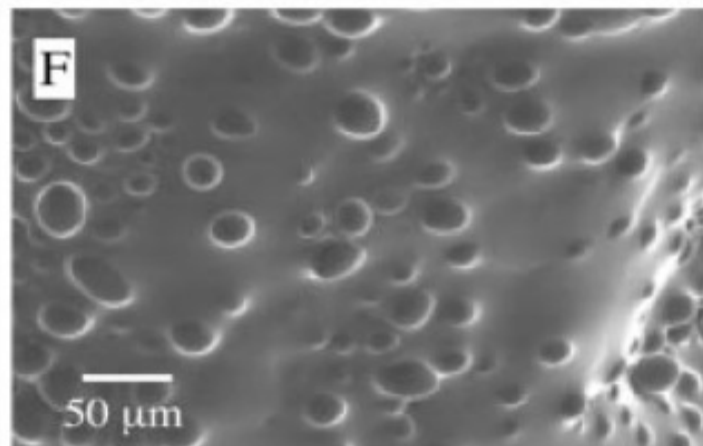
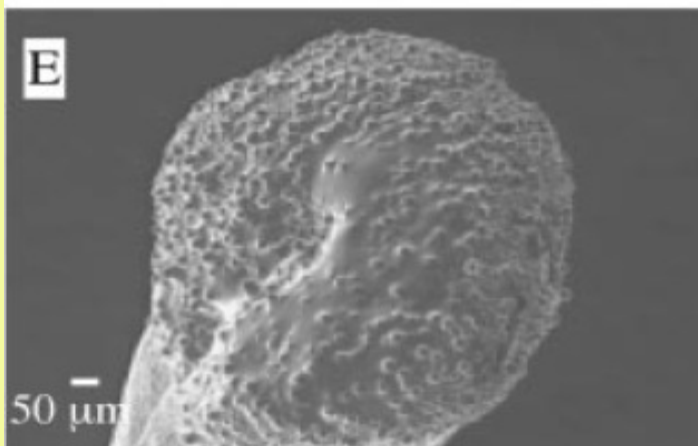
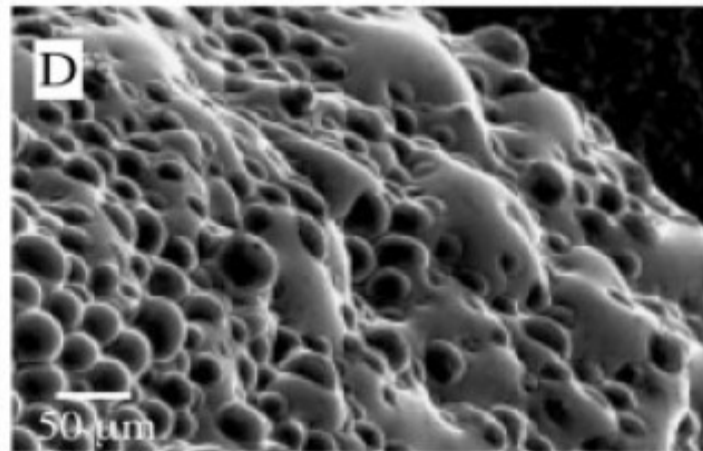
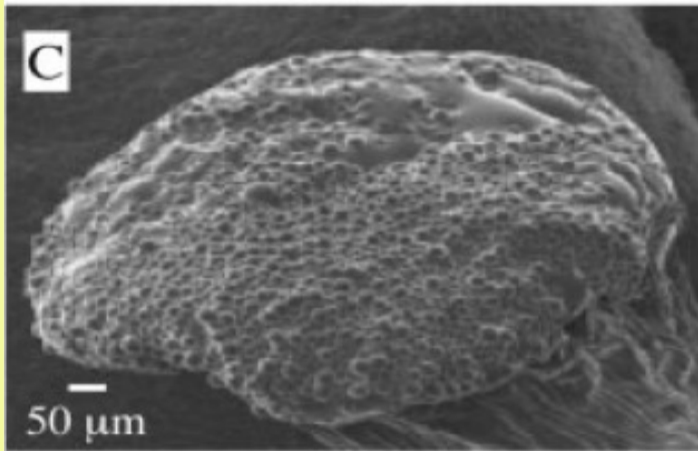
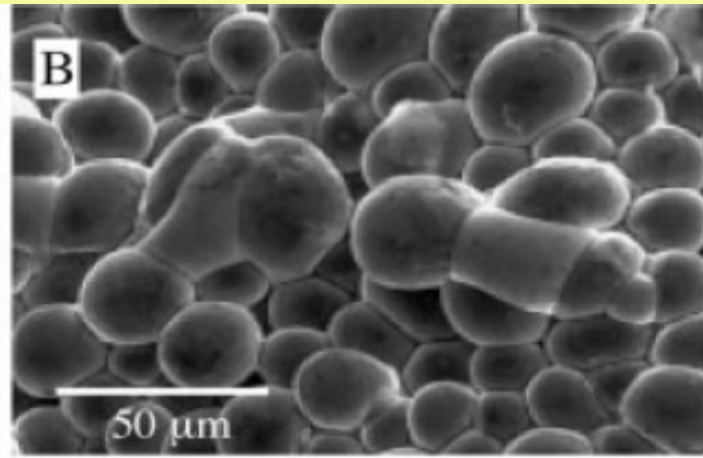
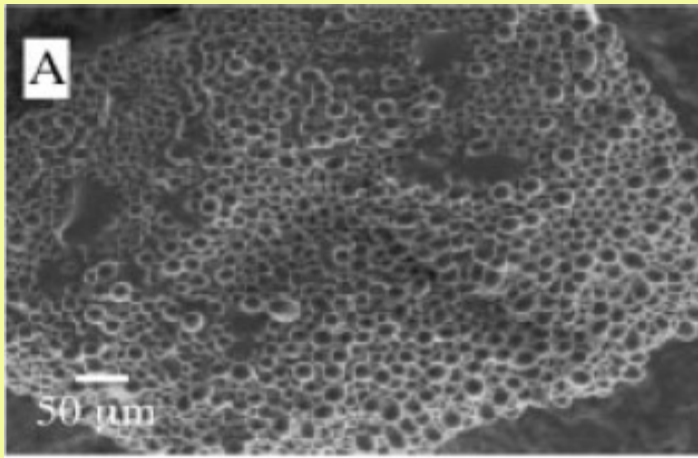
"We got into this, because we were aware of the impacts of airborne pollutants on human health, so it didn't seem so wild that there may be impacts that extended beyond human health," said [University of Southampton neuroscientist Dr Tracey Newman](#), who was involved in the work.

# FLOWER DIAGRAM

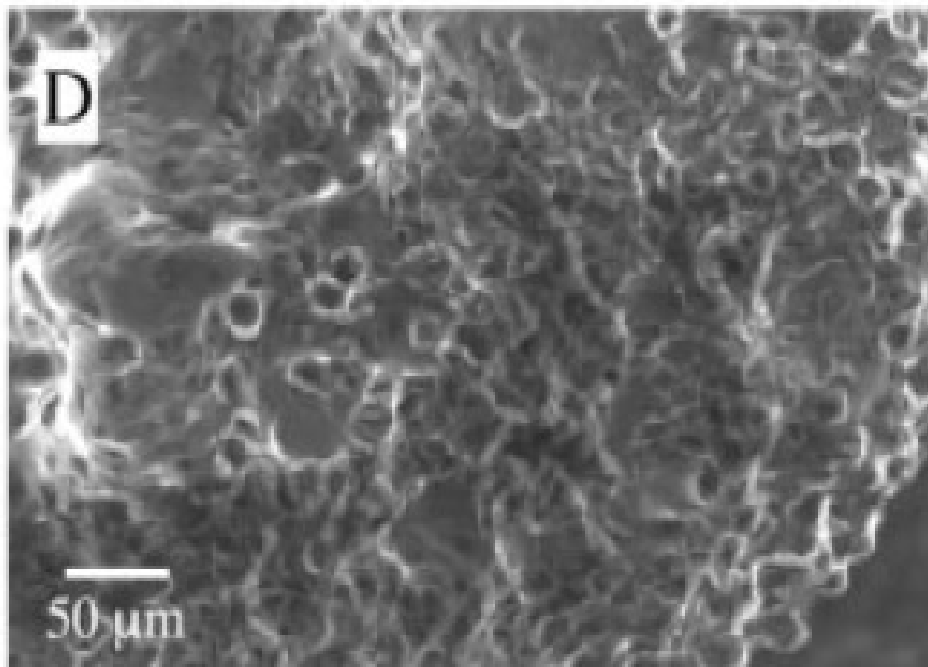
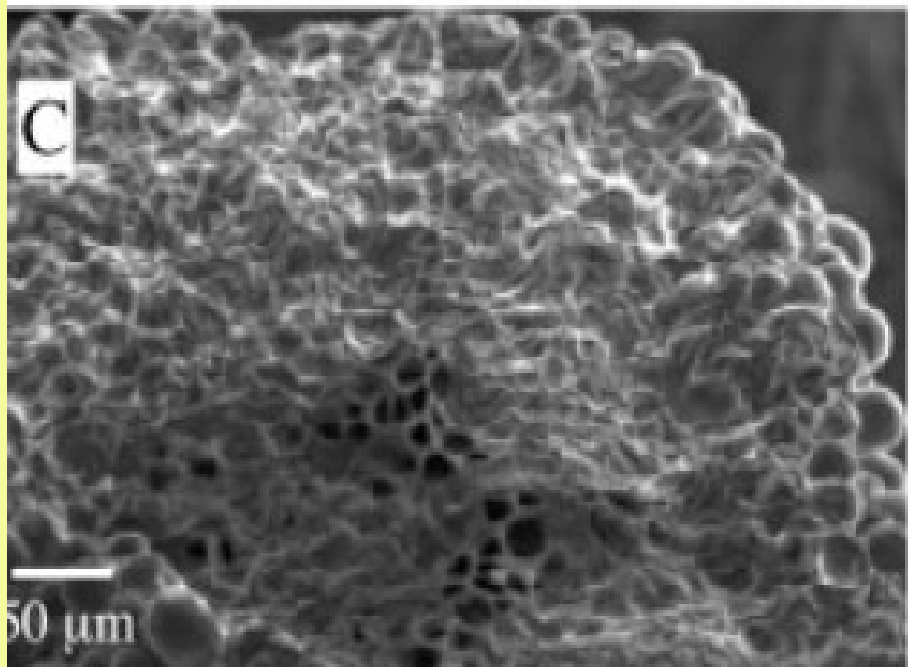
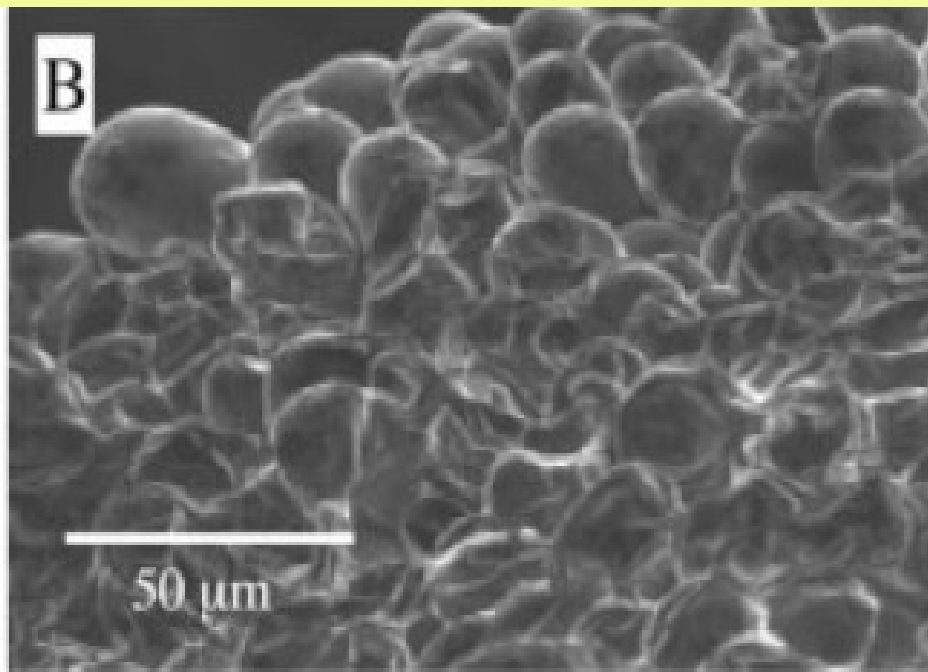
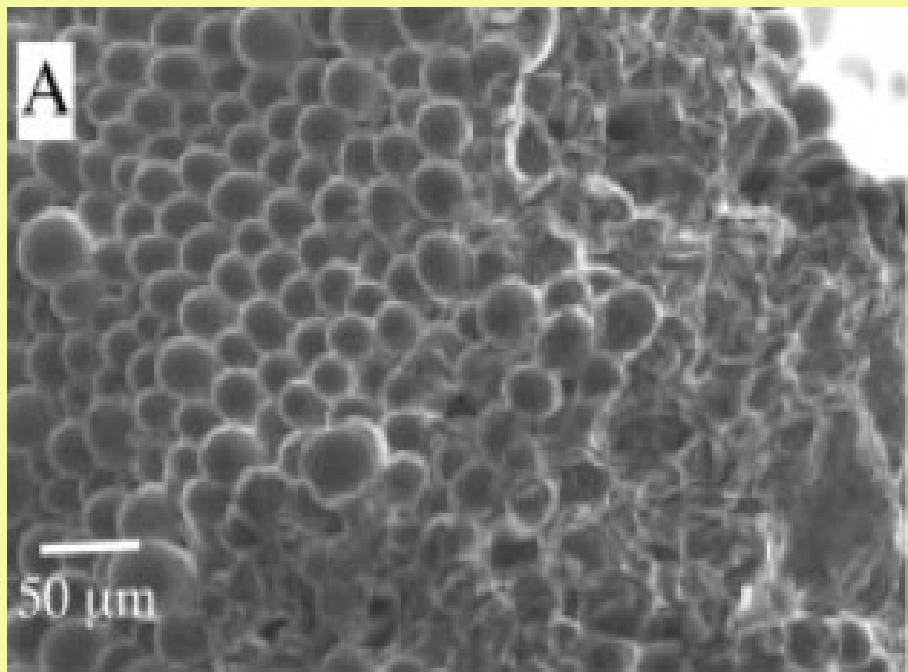




Healthy  
Almond  
Stigma



Almond  
Flower  
Stigma  
Damaged  
By  
Fungicide  
Spray



# Monsanto Honey Bee Health Summit

## June 2013

- Wanyi Zhu – organo-silicone surfactants
  - Mediating viral invasion in bees
  - Impaired learning in bees
  - Synergism of “inert” ingredients and adjuvants
- Frazier – Bee olfactory learning
  - Specific chemical mixes can disrupt memory and learning in bees
  - A 1% shift in nurse bees to field bees can crash a colony in less than a year



Bees have wings  
They have a choice

Other consequences of daytime spray application





1

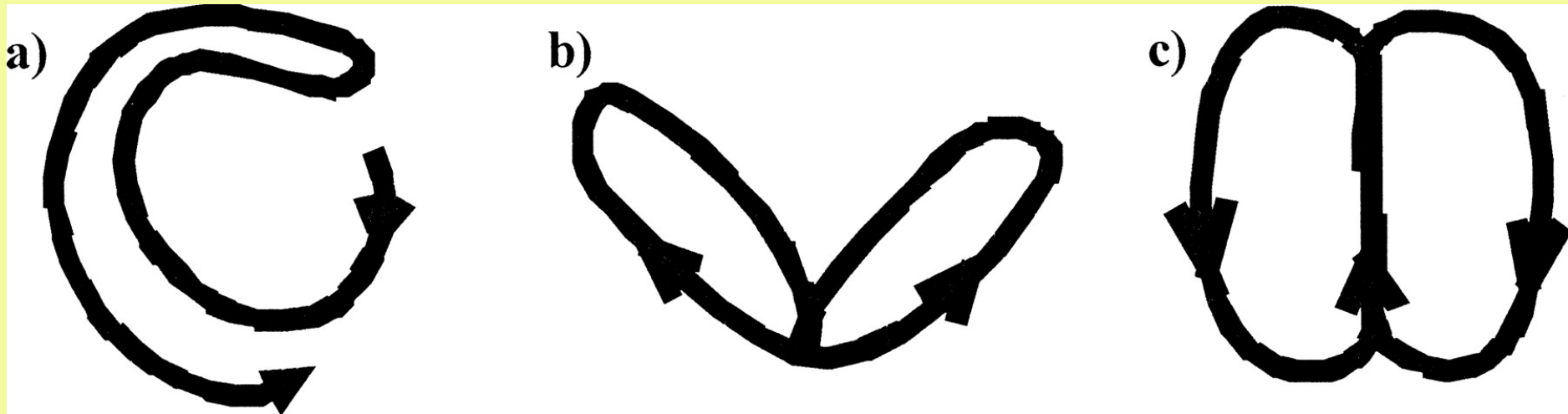


# Honey Bee Dance Language

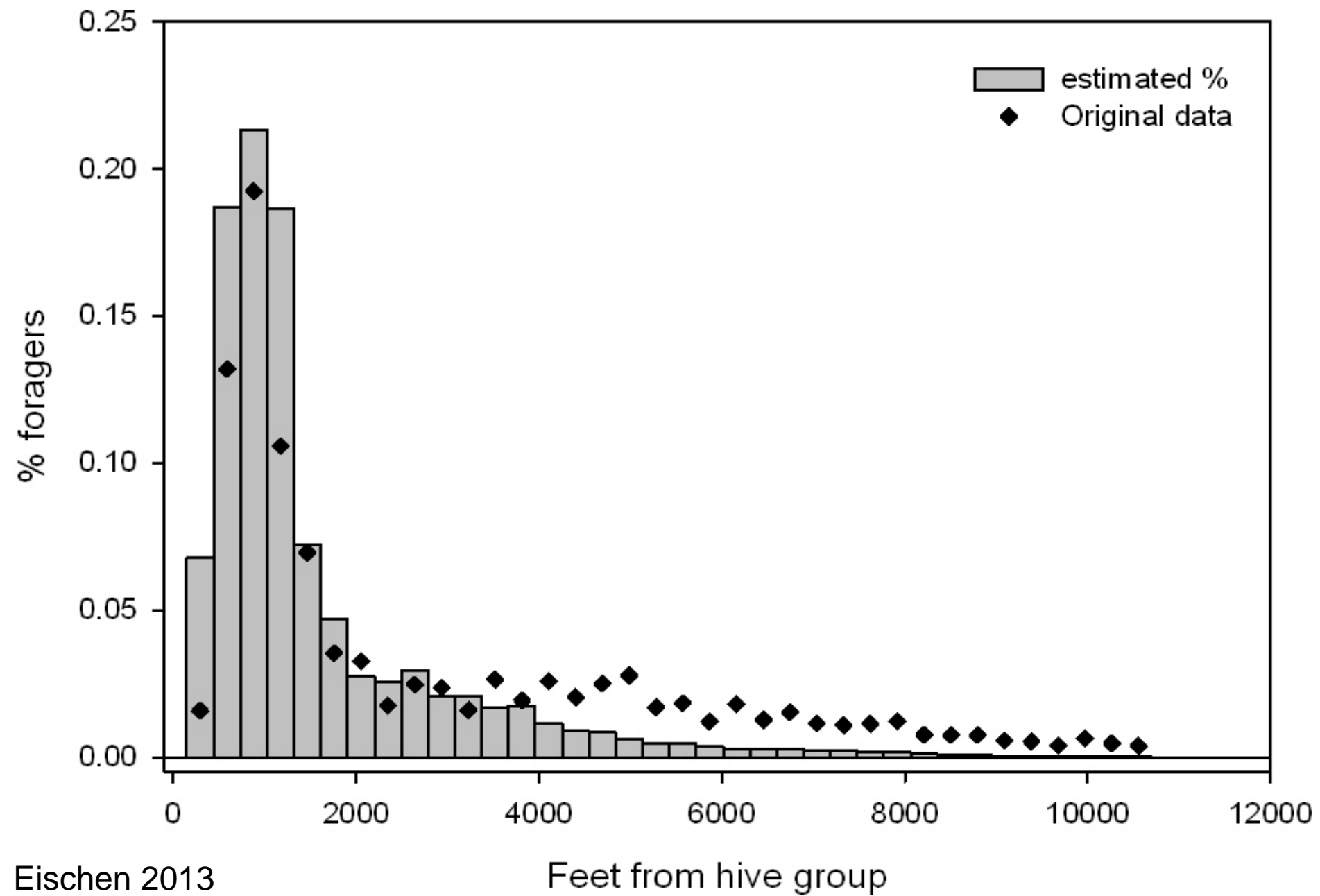
Outside the hive

50 to 150 Meters

> 150 Meters

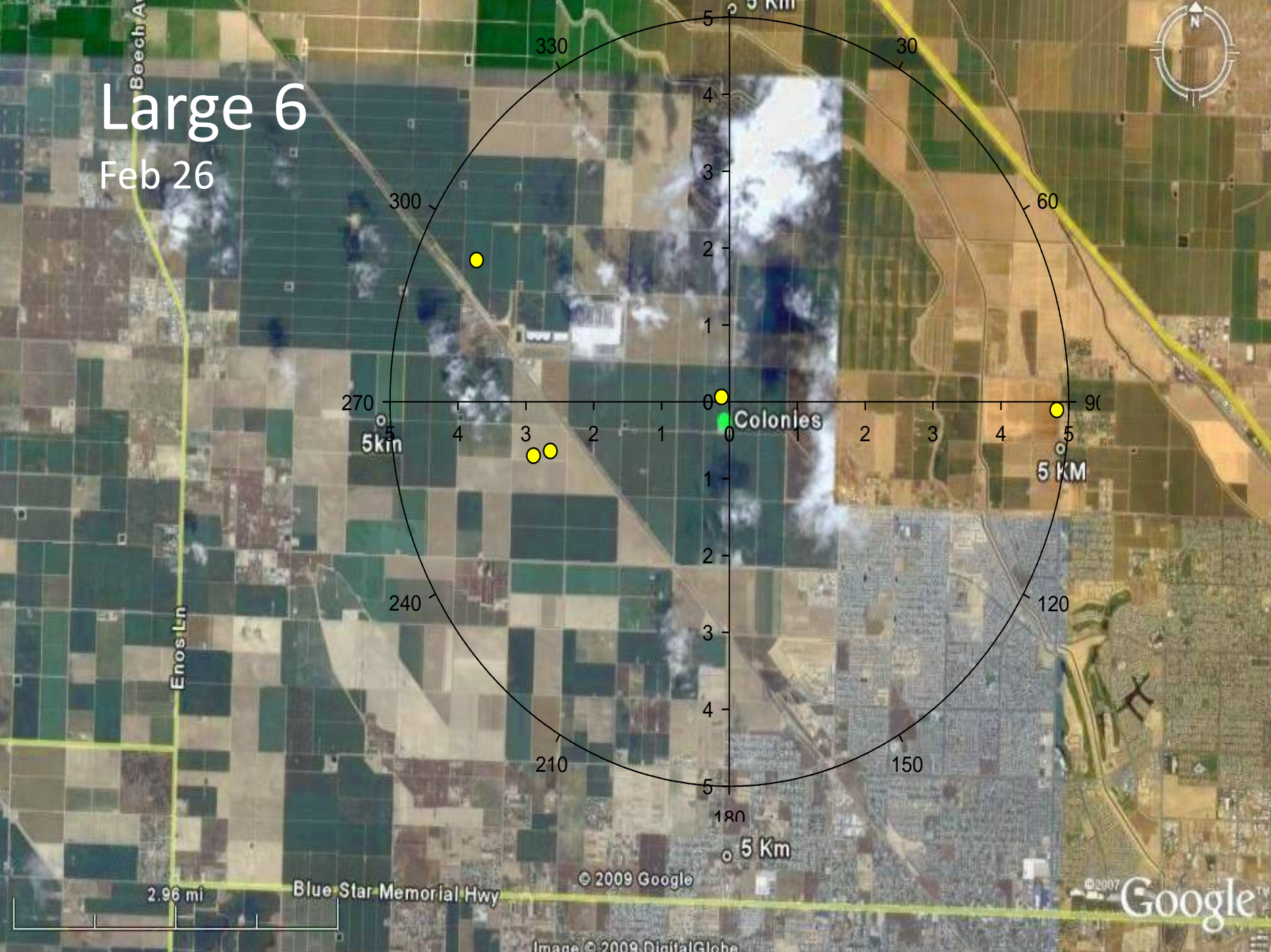


- Direction and Distance to the flowers
- Scent of the flowers
- Taste of the nectar



# Large 6

Feb 26



Beech Av

Enos Ln

Blue Star Memorial Hwy

2.96 mi

5 Km

5  
4  
3  
2  
1  
0  
1  
2  
3  
4  
5

270  
5 Km

300

330

30

60

90

5 Km

120

210

150

180

5 Km

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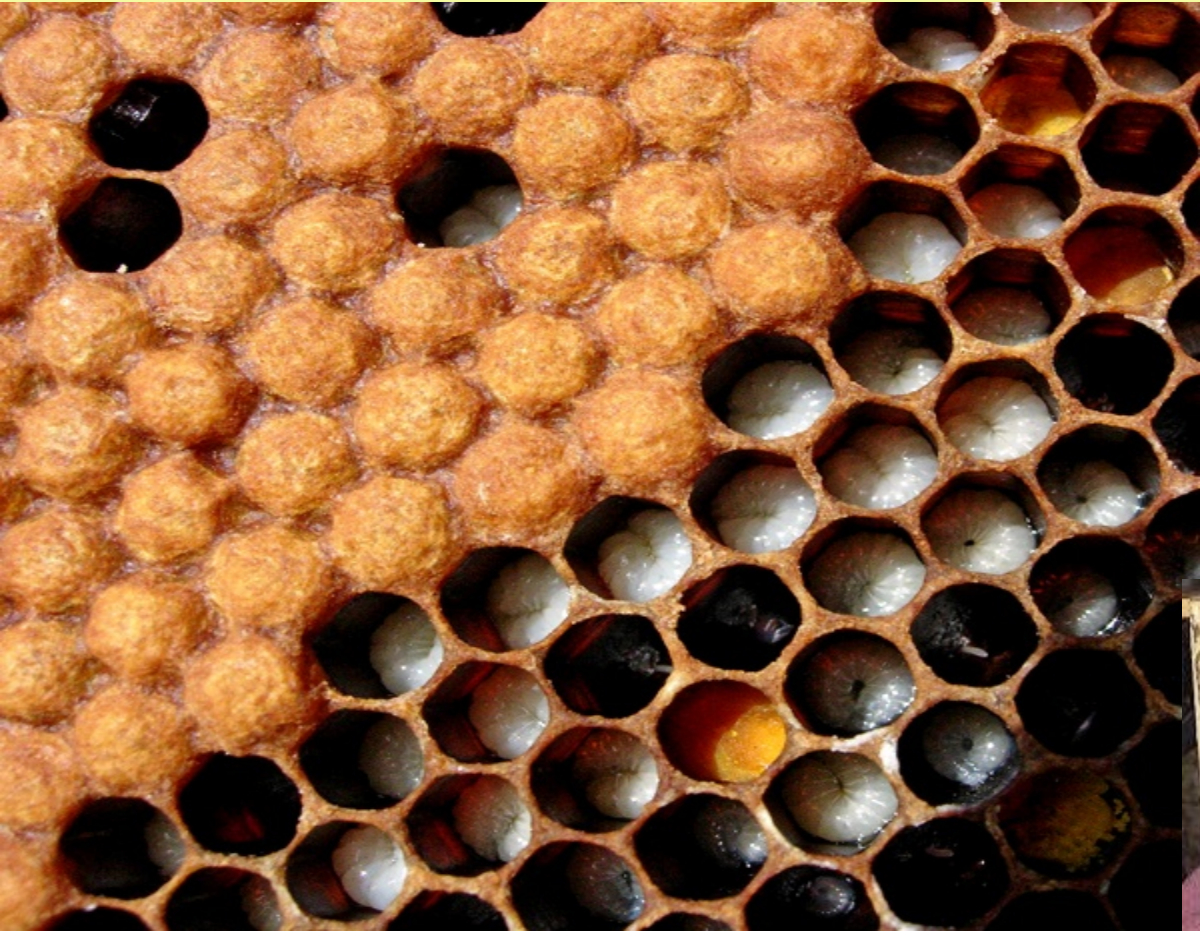
# A Little Bee Biology

## Three Distinct Populations in a Colony

- The Immature Bees (Brood)
  - Eggs, Larvae, Pupae
- The Hive Bees
  - Nurse Bees, Hive Cleaners, Wax Builders, Honey and Pollen Processers, Undertakers and Guards
- Field Bees (Foragers)
  - Pollen Foragers, Nectar Foragers, Water Foragers, Propolis Foragers



# Honey Bee Brood











# Guard Bees





# Foragers













Washboarding Behavior



## ***If Orchards Must Be Treated***

- ***Spray only if you must***
- ***Spray in the late afternoon or evening***
- ***Spray the Safest Materials Around Bees***
- ***Resist the “Free Ride” during bloom***
- ***Avoid Direct Spraying of the Colonies***
- ***Dump and replace water in bee water buckets***
- ***Instruct Equipment Operators to make wide turns around colonies at the ends of rows***

