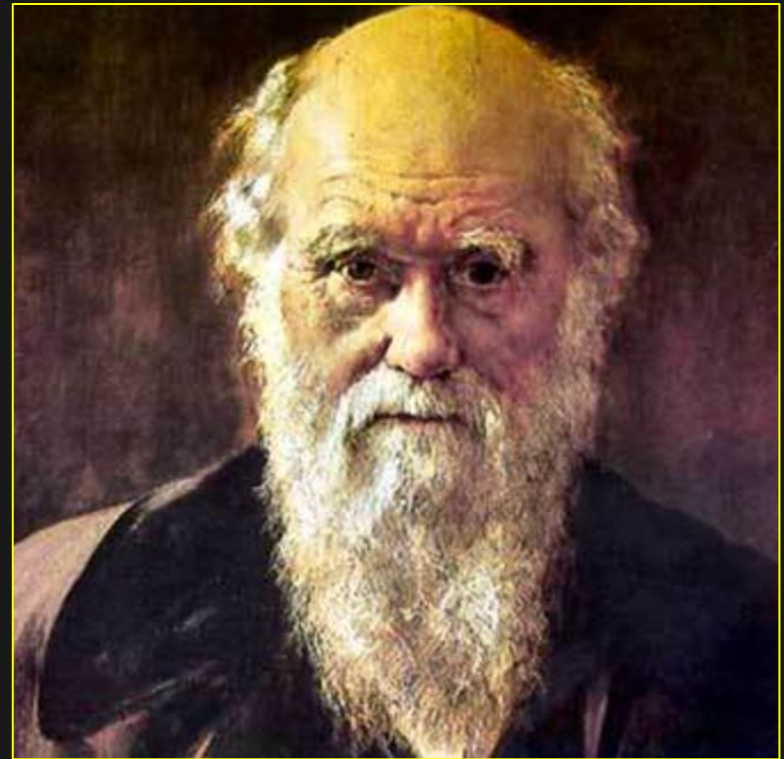


# Darwinian Beekeeping

## An evolutionary approach to apiculture



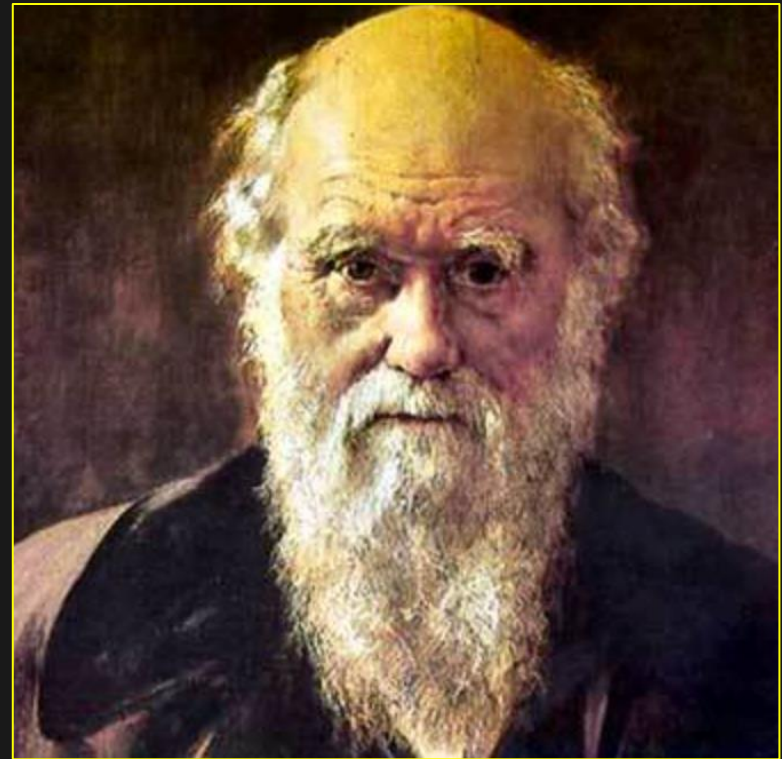
Tom Seeley  
Department of Neurobiology and Behavior  
Cornell University

# Darwinian Beekeeping

## An evolutionary approach to apiculture



Lorenzo L. Langstroth  
1810-1895

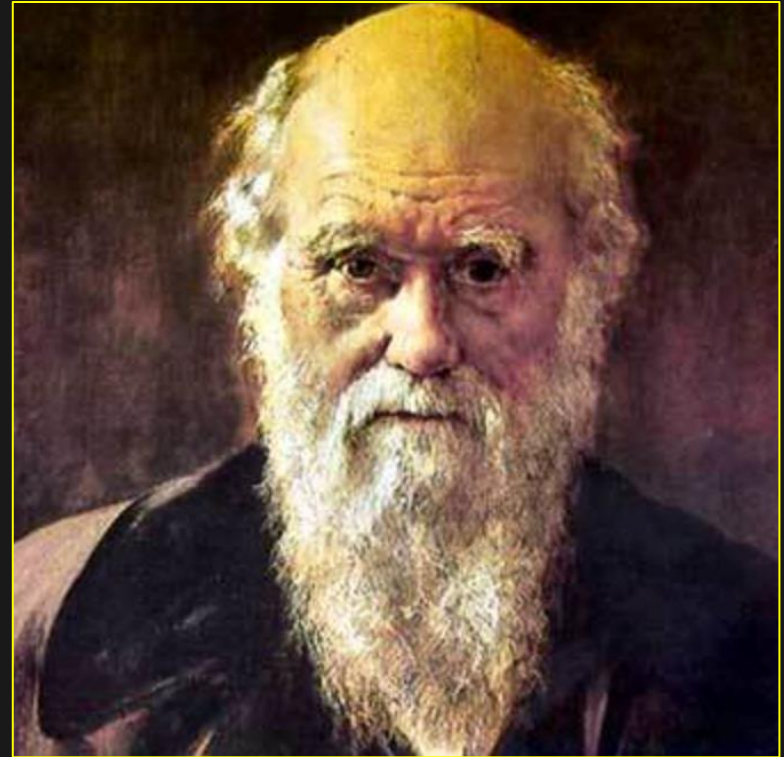


Charles R. Darwin  
1809-1882

# Both studied comb building



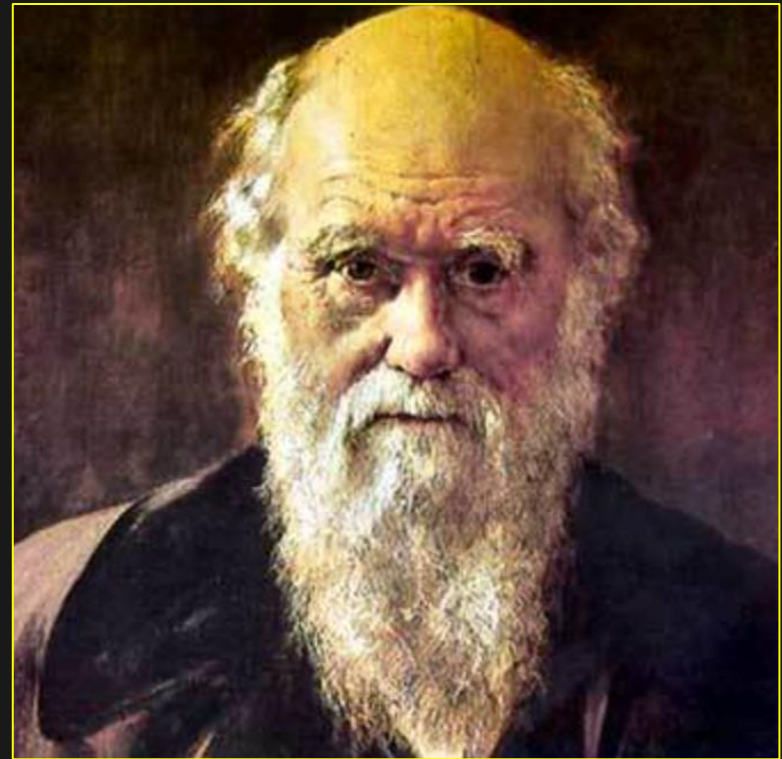
Inventor of the  
movable-frame hive



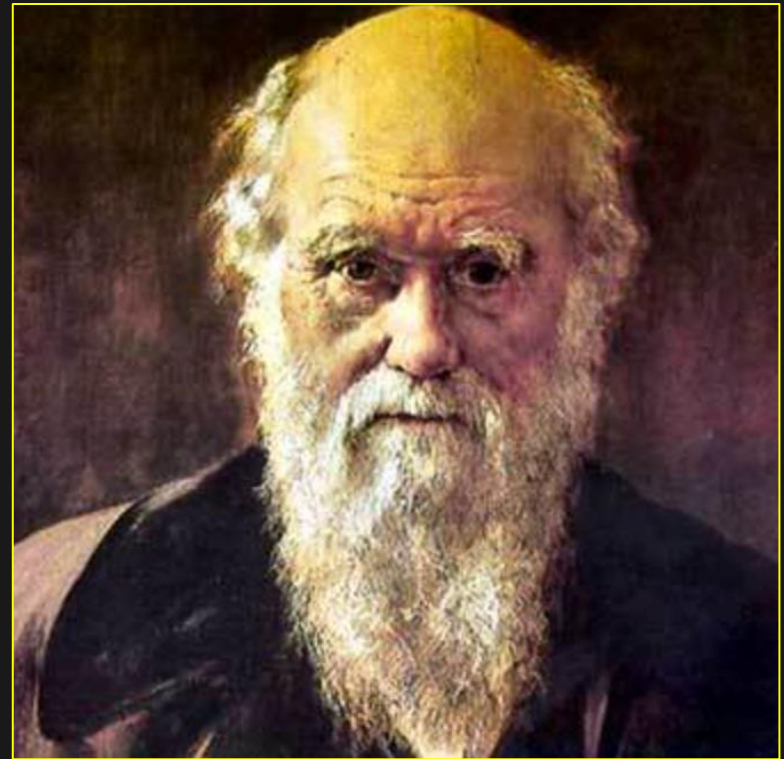
Admirer of comb building by  
honey bees: “the most wonderful  
of all known instincts”



Both had important insights that  
can help us with our beekeeping



Both had important insights that  
can help us with our beekeeping

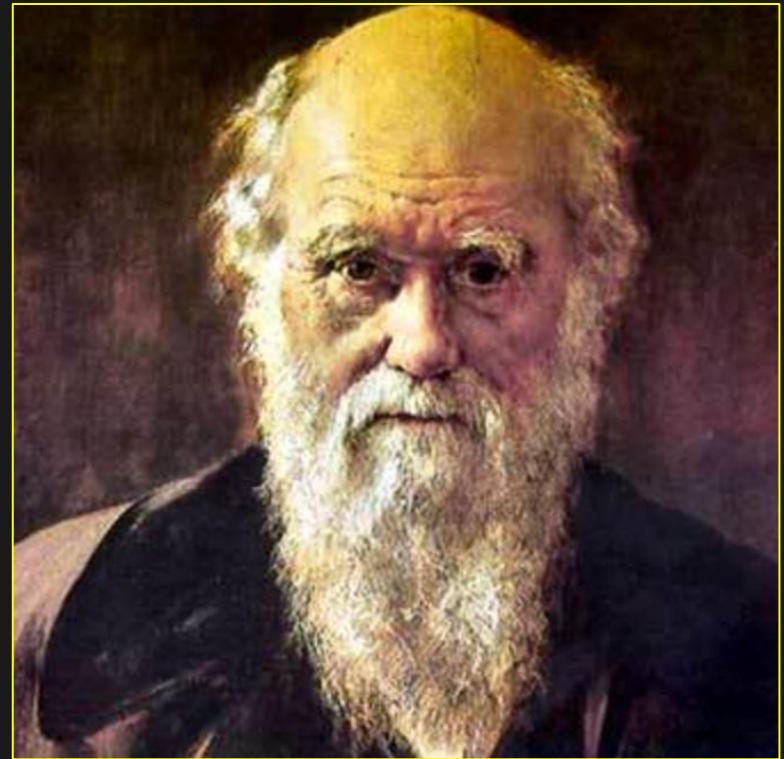


The movable-frame hive,  
a truly wonderful  
invention.

Both had important insights that  
can help us with our beekeeping



The concept of the  
movable-frame hive.



The concept of evolution  
by natural selection.



# Darwin's insight regarding honey bees

Everything that colonies do when they are living on their own (*not being managed by beekeepers*) is done to favor their survival and their reproduction, and thus their success in contributing to the next generation of colonies.



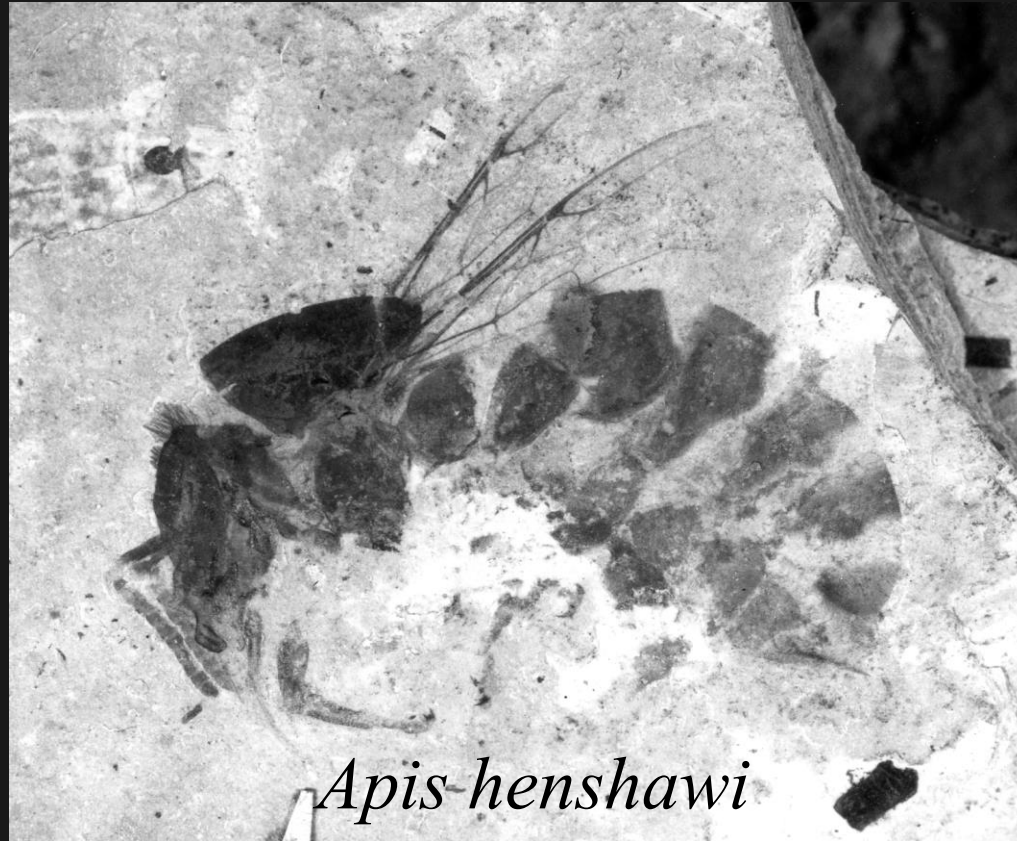
# Darwin's insight regarding honey bees

Everything that colonies do when they are living on their own (*not being managed by beekeepers*) is done to favor their survival and their reproduction, and thus their success in contributing to the next generation of colonies.

In other words, bees are superb “beekeepers.”

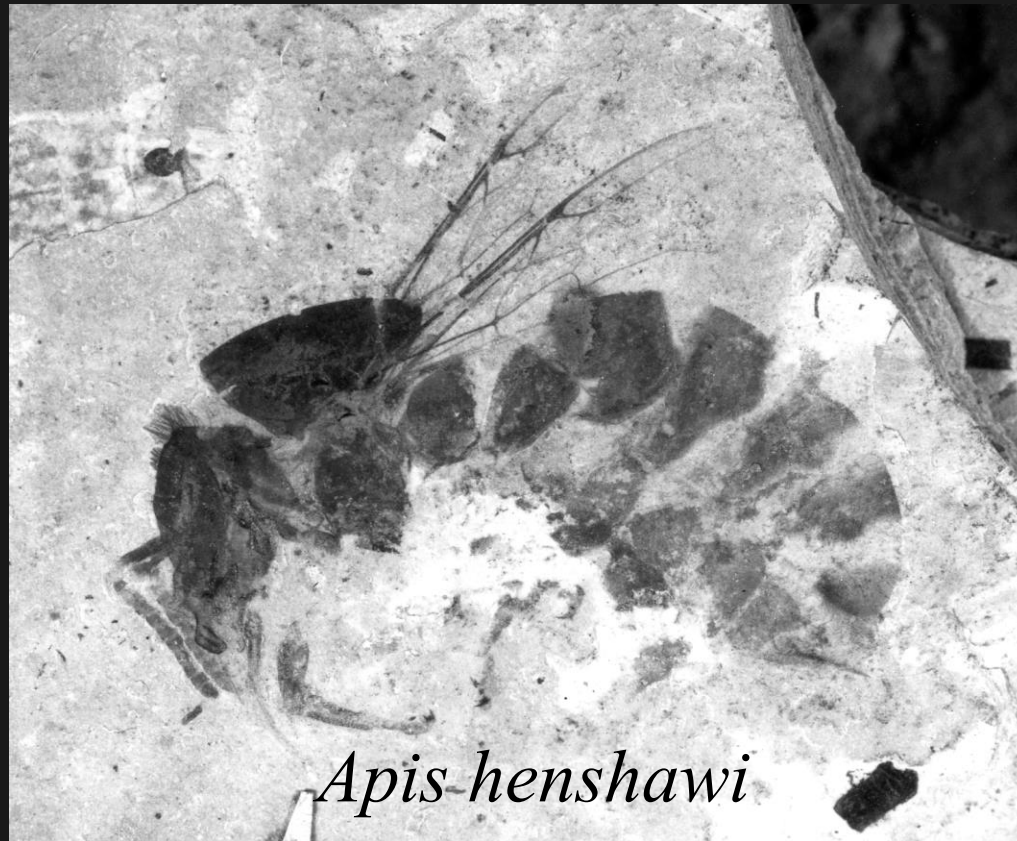


They have been “beekeeping” for a long time



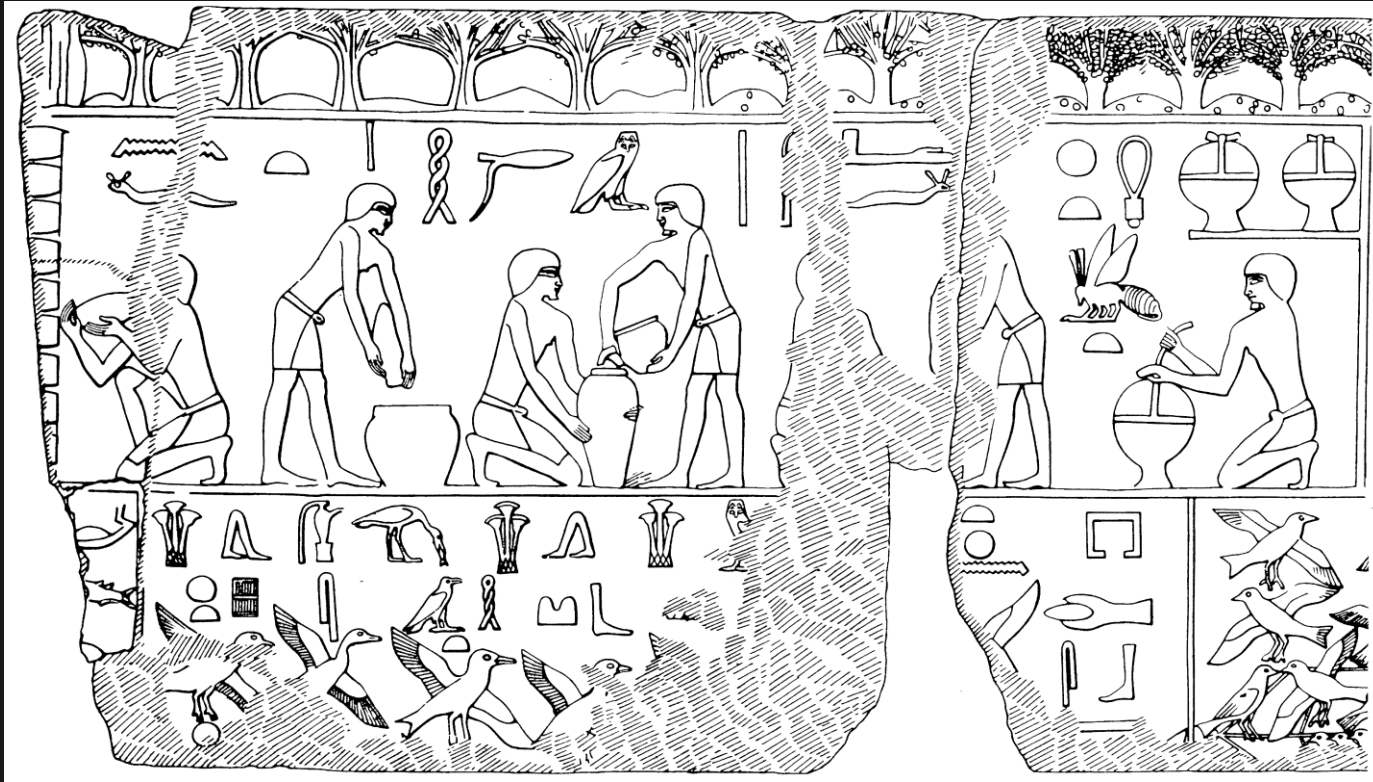
Fossil worker honey bee, from 30-million-year-old shales in Germany

This fossil record shows that honey bees have experienced millions of years of natural selection



Fossil worker honey bee, from 30-million-year-old shales in Germany

# Not all colonies still live in the wild



About 10,000 years ago, humans in Middle East began domesticating plants and animals, including honey bees

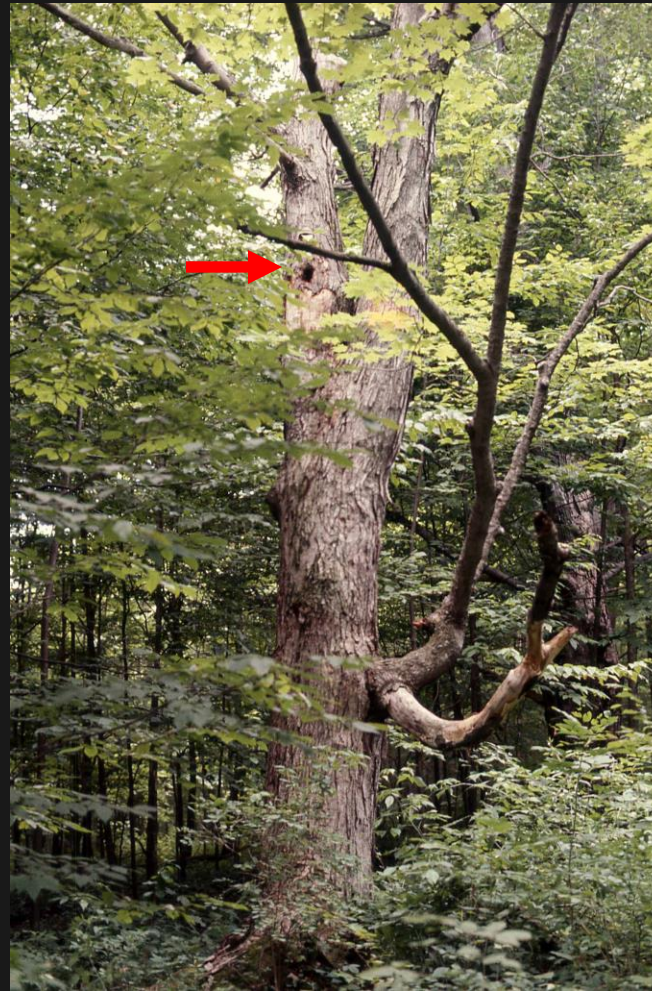
Oldest indication of hive beekeeping, 4,400 years old



# Two groups of honey bee colonies now exist



Managed colonies,  
in hives



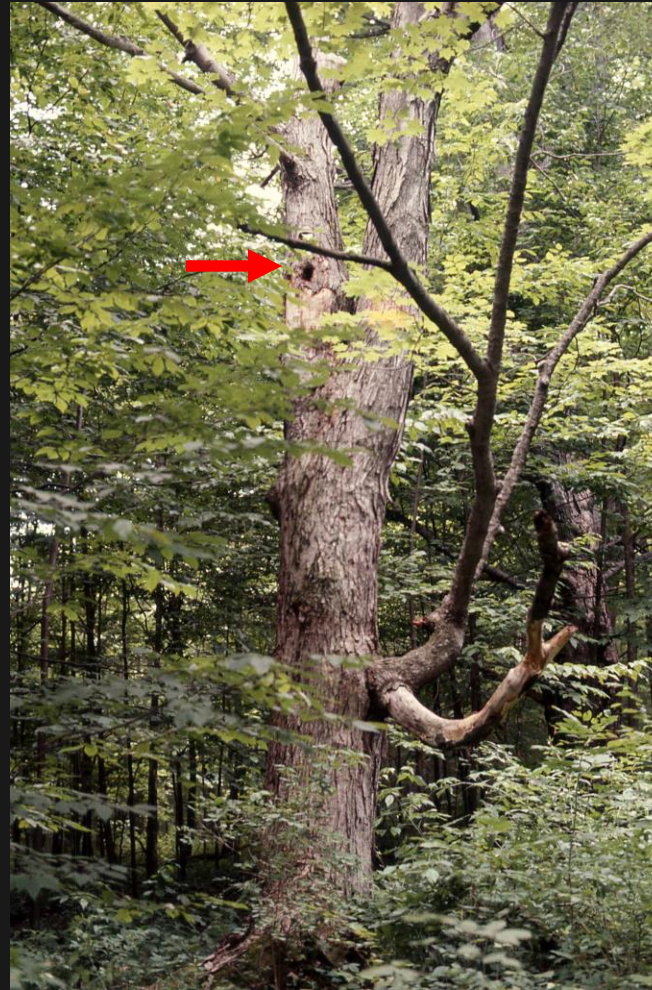
Wild colonies,  
in trees & crevices



# Two groups of honey bee colonies now exist



Managed colonies,  
in hives



Wild colonies,  
in trees & buildings





By early 2000s, general belief: “wild colonies are probably all gone”



Managed colonies,  
in hives



Wild colonies,  
in trees & buildings





August/Sept 2002, I tested this belief.



Managed colonies,  
in hives



Wild colonies,  
in trees & buildings

True?





August/Sept 2002, I tested this belief.



Managed colonies,  
in hives



Wild colonies,  
in trees & buildings

True?

No.





# The Arnot Forest, 4200 acres, 6.5 sq mile



The ONE place in Europe and North America  
with data on wild colony abundance before &  
after arrival of *Varroa*:

**Before (1978):** 2.5 colonies per square mile

**After (2002):** 2.5 colonies per square mile



# The Arnot Forest, 4200 acres, 6.5 sq mile



These wild colonies have *Varroa*, but they are persisting. How?

What can we beekeepers learn from these bees?

# Comparison of the environments in which wild colonies and managed colonies live

Environment of evolutionary  
adaptedness

(original environment)

In which wild colonies live.

Current circumstances

(novel environment)

In which managed  
colonies live.

# Comparison of the environments in which wild colonies and managed colonies live

## Environment of evolutionary adaptedness

1. Colonies genetically  
adapted to their location

## Current circumstances

Colonies not genetically  
adapted to their location



# Comparison of the environments in which wild colonies and managed colonies live

## Environment of evolutionary adaptedness

1. Colonies genetically adapted to their location

## Current circumstances

Colonies not genetically adapted to their location

**The Ultimate Queen Bee from Hawaii!**  
Carniolan and Italian Queens Available

**Hawaiian Queen Co., Inc.**

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gentle temperament and hygienic  
behavior from all our queens.

Call 808-328-2656 to place your order.  
[www.hawaiianqueen.com](http://www.hawaiianqueen.com)

## Environment of evolutionary adaptedness

2. Colonies live widely  
spaced in woods



## Current circumstances

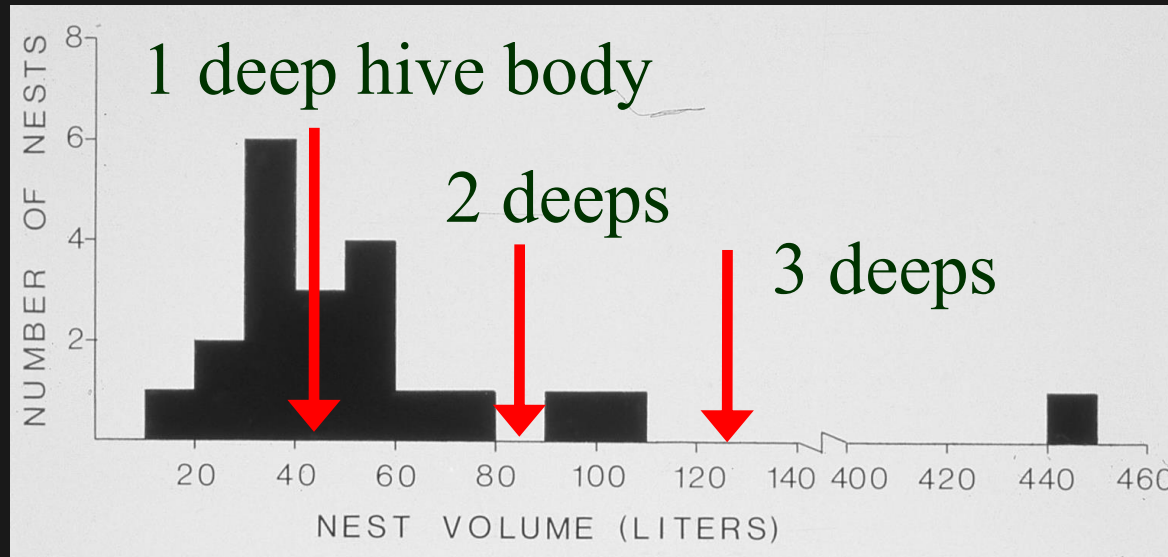
Colonies live crowded in  
apiaries





## Environment of evolutionary adaptedness

3. Colonies live in small nest  
cavities (ca. 1 deep hive  
body) and swarm freely



## Current circumstances

Colonies live in super-sized  
nest cavities (multistory  
hives) and swarm rarely





## Environment of evolutionary adaptedness

4. Nest cavity walls are  
coated with propolis

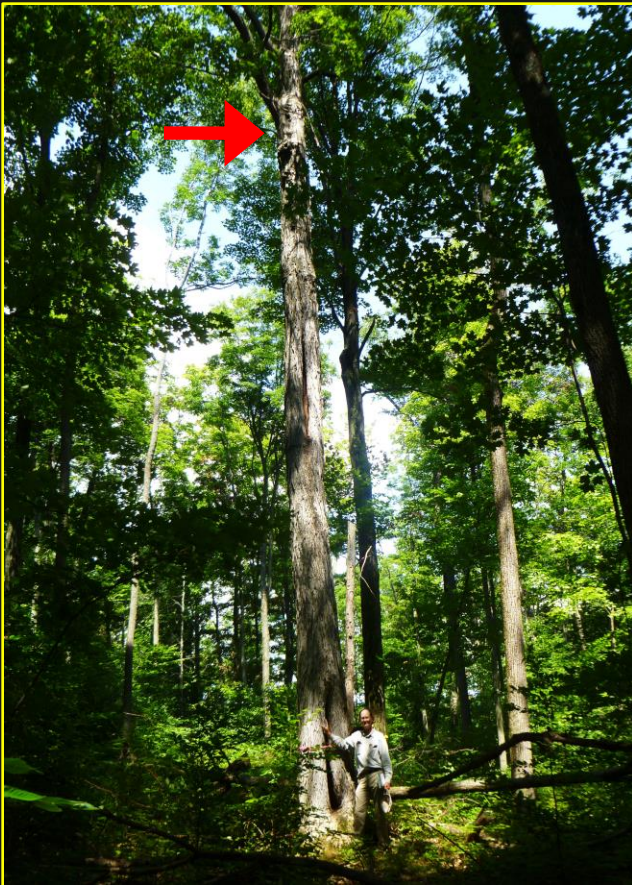


## Current circumstances

Hive walls are not coated  
with propolis

## Environment of evolutionary adaptedness

5. Nest entrance is high off  
ground (avg. ca. 25 feet)



## Current circumstances

Nest entrance is low to  
ground (< 1 foot)





## Environment of evolutionary adaptedness

6. Colonies have diverse  
pollen sources



## Current circumstances

Colonies sometimes have  
non-diverse pollen sources



## Environment of evolutionary adaptedness

7. Colonies are not treated  
for diseases.



## Current circumstances

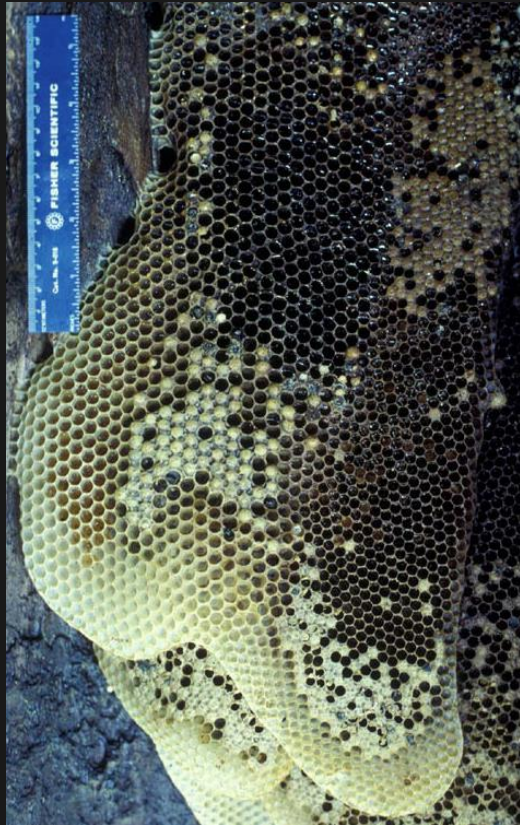
Colonies are treated for  
diseases.





## Environment of evolutionary adaptedness

8. Colonies build drone  
comb freely; produce many  
drones



## Current circumstances

Colonies discouraged from  
building drone comb;  
produce fewer drones.



# Darwinian Beekeeping

- Insofar as possible, put managed colonies back in the honey bee's environment of evolutionary adaptedness
- Let managed colonies live more naturally
- Colonies will make **less honey**, but they will have **better health**
- Key point: a tradeoff between **honey production** and **colony health**



# Darwinian Beekeeping

some specifics (see ABJ, March 2017)

## 1. Keep bees that are adapted to your location

- Rear queens from your best survivor colonies, OR
- Capture swarms with bait hives in remote locations, OR
- Purchase queens from a queen breeder who produces locally adapted queens, e.g. a member of the Northern States Queen Breeders Association

--Mike Palmer, French Hill Apiaries, Vermont

--Dan Conlon, Warm Colors Apiary, S. Deerfield, Mass.

--Kirk Webster, New Haven, Vermont

# Darwinian Beekeeping

## 2. House your colonies in small hives

- One deep 10-frame hive body + 1 shallow honey super over Q excluder (extract the honey, or produce comb honey)
- Colonies will swarm; only 16% annual mortality even without mite treatments (google: Seeley, Apidologie, life-history traits) so long as colony density is low (hence no "mite bombs" nearby)



Simulated wild



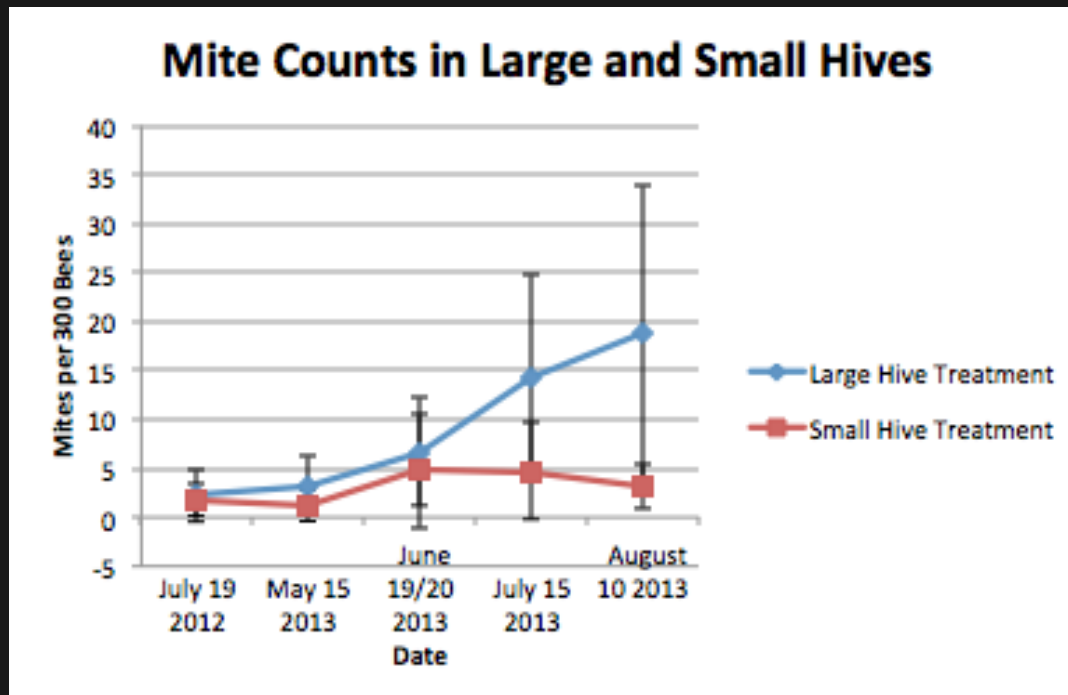
Honey production



# Darwinian Beekeeping

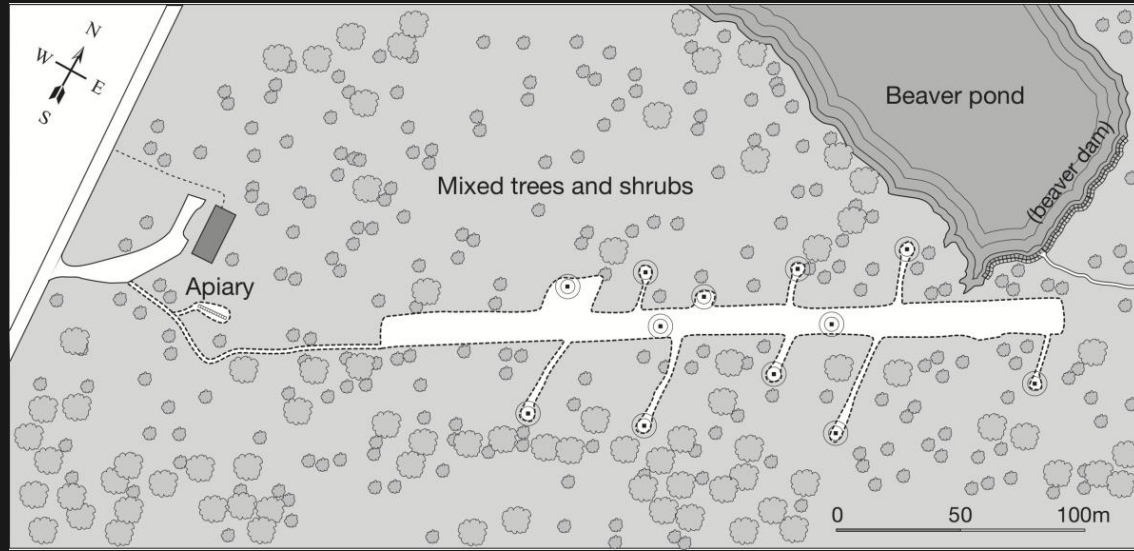
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# Darwinian Beekeeping

## 3. Space your colonies as widely as possible



- Less drift of bees between colonies
- Less spread of mites between colonies
- Better survival of colonies (all were untreated, all had sister queens from California)



# Darwinian Beekeeping

## 3. Space your colonies as widely as possible

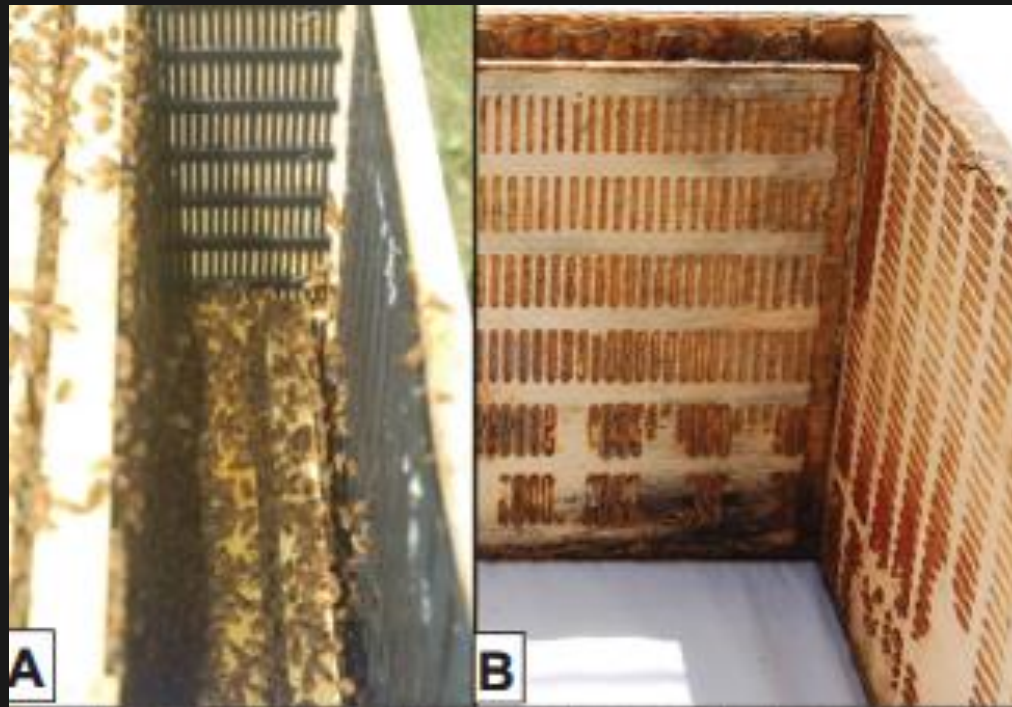


Strong “mite bomb” phenomenon among crowded colonies,  
but not among dispersed ones

Seeley, T.D. and M.L. Smith. 2015. Crowding honeybee colonies in apiaries increases their vulnerability to the deadly ectoparasitic mite *Varroa destructor*. *Apidologie* 46:716-727.

# Darwinian Beekeeping

4. Line your hives with propolis collection screens, or build them of unplanned lumber



Propolis envelope functions as an antimicrobial “shroud”  
Borba, Klyczek, Mogen & Spivak (2015)



# Darwinian Beekeeping

5. Provide your most resilient (lowest mite count) colonies with 10-20% drone comb



Promote the genetic success of your  
best colonies

# Darwinian Beekeeping

## 6. Keep nest structure intact



Put each frame back in original location and with original orientation; no reversing of brood boxes



# Darwinian Beekeeping

7. No top entrance, use just a small bottom entrance (bees work hard to close top openings with propolis)



2" wide entrance opening, with  $\frac{1}{2}$ " mesh screen (mouse excluder) stapled over opening

# Darwinian Beekeeping

7. No top entrance, use just a small bottom entrance  
(bees work hard to close top openings with propolis)



Add Derek's  
diagram!!!

Condensation in hive is the bees' water source in winter!!!



# Darwinian Beekeeping

8. Do not disturb colonies in winter: no checking, no stimulative feeding, no pollen patties, etc.



Even just a brief removal of lid causes winter cluster to raise its temperature in alarm for several hours

# Darwinian Beekeeping

## 9. Refrain from treating colonies for *Varroa*

- Requires super diligent beekeeping
  - You must monitor mite levels (mites/300 bees) in your colonies
  - If mite level gets high (more than 15 per 300 bees), then euthanize the colony; pour warm, soapy water into hive at dusk)
  - This does two things:
    1. Eliminates your non-resistant colonies (is nat. selection)
    2. Avoids producing mite bombs
- Alternative to euthanasia of colony: treat for *Varroa* and requeen with a queen of resistant stock



# Darwinian Beekeeping

## An evolutionary approach to beekeeping

### Environment of evolutionary adaptedness (EEA)

---

1. Colonies genetically adapted to climate
2. Colonies live widely spaced
3. Colonies occupy small cavities
4. Colonies are rarely disturbed
5. Honey not harvested
6. Colonies eat nectar & pollen
7. Colonies not treated for disease

### Current circumstances

---

- Colonies not genetically adapted to climate
- Colonies live crowded together
- Colonies housed in large hives
- Colonies are often disturbed
- Honey harvested
- Colonies often fed artificial diet
- Colonies are treated for disease

Thank you for your  
interest and attention!



# Darwinian Beekeeping

(with a big nod to Darwinian Medicine)

An evolutionary approach to beekeeping

1. Refrain from treating colonies for Varroa. Let natural selection work.
2. Work with bees that are adapted to your location. Capture swarms with bait hives to get good stock.
3. Space your hives as widely as possible. Even a 10-20 m separation can be helpful.
4. House your bees in small hives. You lose some honey production, but you gain much in bee health.