

2026 Stahlman Bee Notes

Published By-Monthly by Dana Stahlman

Issue # 16 Vol. 8 August (**Comb Management**) Previous issues are available at www.ccbee.org

During their very short life measured in days and not years, honey bees follow a pattern of behavior that has existed for millions of years. Honey bees react to rewards, they communicate information with each other, they solve problems, and they remember previous information.

Early man recognized the architecture of bees. Mathematicians studied comb and marveled at the structure required to carry great weights. Honey bees don't just secrete wax produced by wax glands; they must attach wax to support the comb they build. The intelligence required of a group of bees to build comb has been studied. Bees do measure and make decisions on where to build the nest (see *Honeybee Democracy* by Thomas Seeley).



This photo shows bees beginning to build comb in a behavior called festooning. Bees start from the top (roof) of a dwelling and build downward starting with one bee followed by a curtain of bees suspended from each other to build a structure. In nature, a comb nest forms a fantastic network of cells.

Wax workers and nurse bees have distinct separate tasks in this nest

building operation. Bees will construct thousands of cells making comb of various thickness. Worker brood comb is just seven-eighths of an inch thick while cells storing honey can be almost two inches thick.



There are 48 cells to a square inch for worker cells, counting both sides of the comb. They also determine when and where to build drone comb which is 32 cells to the square inch counting both sides. Some cells are not perfect but bees connect comb in such a way as to support the weight and strength of a comb structure. The space between combs is narrow usually one-quarter to three-eighths of an inch wide **and any violation of this space is corrected almost immediately by bees.** See how the bees manage the space between combs in a wild bee nest as shown above.

The hexagonal structure used by bees is remarkable for it is best adapted to contain the greatest possible quantity of honey or brood in the least possible space and uses the least quantity of wax.

The remarkable **strength of the honey bee's hexagonal comb** have been recognized for more than **2,000 years**. Many mentions of comb building have been made by those early writers using skep hives. For the most part comb building could only be observed in bits and pieces. *The True Amazons: Or, Monarchy of Bees* (1726) By Joseph Warder is just an example.

But to put the Matter beyond all Controversy; let any Body but put it to a Tryal, as I have several Times, by the following Experiment.

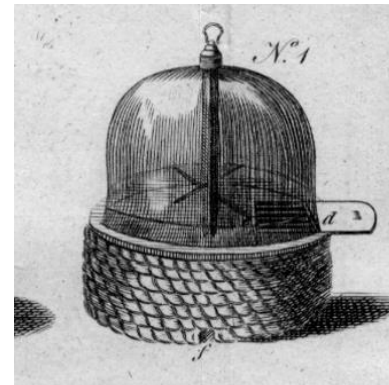
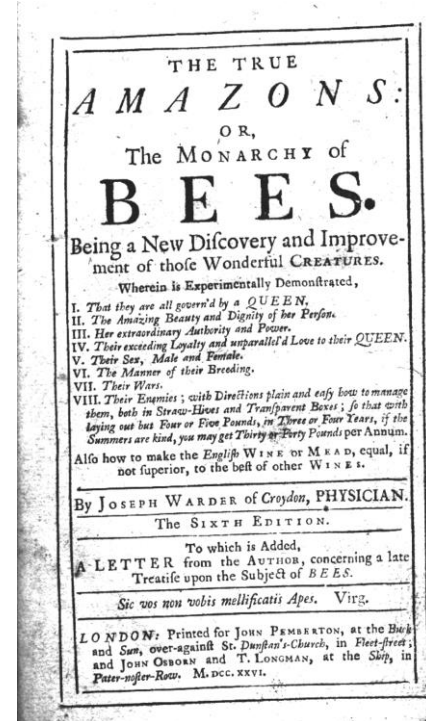
Put a Swarm of Bees of a Peck, in May, into a Hive of Glafs that will hold half a Bushel, and they will, if it be good Weather, fill it with Combs down to the Stool, in less than a Month, which will also be well stored with Honey, and some of the Combs employed from the first in Breeding, so that with the Combs and the Bees, the Hive will be exceeding full, that there is not Room enough to contain them all in the Hive; nay sometimes they will actually Swarm,

The modern translation of his comment on comb building is shown below in modern English making it easier to read:

But to put the matter beyond all controversy, let anybody put it to a trial, as I have several times by the following experiment. Put a swarm of bees of a peck (1/4 of a bushel), in May, into a hive of glass that will hold half a bushel, and they will, if it be good weather, fill it with combs down to the stool (a hive stand) in less than a month, which will also be well stored with honey, and some of the combs employed from the first in breeding (brood), so that with the combs and the bees, the hive will be exceeding full, that there is not room enough to contain all the bees in the hive, nay sometimes they will actually swarm.

In the meantime (almost 200 years) we manage comb construction with an eye on getting the bees to do it right. Even when frames were used, beekeepers found that honey bees would attach comb to the side-walls of the hive requiring a knife to cut the comb loose before removing the frame the comb was attached to. Today, we credit L.L. Langstroth with recognizing that bees attach comb to almost anything except when there is a small space (a space where two bees can pass) between comb and something to attach it to. Any space larger than 3/8" results in bees filling the void with more comb. If smaller than 1/4 inch, the bees will glue the space shut with propolis. This makes opening a hive to remove frames almost impossible unless one is equipped with a knife or hammer and chisel. Of course, this would disturb the bees and they would react by becoming very aggressive.

A word of Wisdom: Work slowly and with as little disturbance as possible when a hive is open and one is removing frames. I have found a little smoke applied to the top bars will cause bees to retreat lower down on the frame. When bees set about building comb where it doesn't



belong (according to us), identifying the cause is easy to determine. We violated the bee space rule!

Honey bees will correct screw-ups by beekeepers. The following photos demonstrate this:



Photo 1 [This is the bees solution to a beekeeper removing a bee package without filling the empty space with frames of comb.] Photo 2 [The bees solution to filling space below a medium frame placed in a deep super.] Photo 3 [The bees solution to spacing frames too far apart.]



Photo 4 [The bees answer to plastic foundation frames spaced too far apart] Photo 5 [Same for this photo – too much room between frames] & Photo 6 [This is a queen excluder with too much space between it and the bottom bars of the hive body above it.]

The reason I am sharing these pictures is to show that even 200 years later, honey bees are still designers of where and how comb is built. We have adapted ways to get them to build the comb straight on foundation.

With the popularity of plastic foundation taking hold, many of the issues with comb have divided beekeepers on what is best. Some still think natural wax foundation is best. Bees do like it better than plastic. However, when beeswax is used to coat plastic, plastic offers a few advantages. It saves a lot of labor putting foundation into frames. Many beekeepers using natural wax take short cuts and these result in a number of problems. Beeswax is soft and must be wired in frames that will hold honey and brood. Comb that is poorly wired can stretch causing serious problems.

One problem beekeepers are facing now is something far different than beekeeping 20 to 30 years ago. Varroa mites are a problem! But it is just one of many issues facing the survival of honey bee colonies.

How old is the comb in your hives? Replacing old comb has been talked about from the time I began beekeeping. Dark and misshaped comb has always been replaced when good comb management is practiced.



This is a piece of comb almost 100 years old full size taken from a bee lining box. Bee lining is almost a lost art today. But this piece of comb is interesting because over time it has retained its shape and survived many years. Much of the comb has been damaged by handling but a few cells still have the shape and size for an egg to be laid in them.

It would be possible for scientists to check this comb for chemical residue because brood comb acts somewhat like a long-term environmental record. Comb readily absorbs substances introduced into the hive.

In 2023 Cornell University studied beeswax collected from various sources in New York State for pesticides. All samples indicated some contamination for pesticides. The screened samples found 34 fungicides, 33 insecticides and 22 herbicides. Every individual comb sample examined contained from 7 to 35 different chemical residues. **A list of contaminants found is on the next page.**

Why beeswax becomes contaminated

Worker bees bring contaminants back to the hive from:

- Agricultural crops
- Roadside vegetation
- Urban landscapes
- Industrial dust
- Water sources
- Beekeeper-applied miticides

Once in the hive, these compounds become incorporated into comb, where brood is reared generation after generation. Since bees continually re-use comb, contamination tends to increase with comb age.

The Cornell researchers concluded that:

- **Old brood comb acts as a long-term reservoir for pesticides.**

Regular replacement of old comb can reduce the colony's chemical burden

Contaminant	Source
Piperonyl butoxide	Pesticide synergist
Coumaphos	Varroa mite treatment
Amitraz metabolites (2,4-DMPF)	Varroa mite treatment
Difenoconazole	Fungicide
Azoxystrobin	Fungicide
Pyraclostrobin	Fungicide
Trifloxystrobin	Fungicide
Atrazine	Herbicide
Metolachlor	Herbicide
Diuron	Herbicide
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Pyraclostrobin	Fungicide
Trifloxystrobin	Fungicide
Atrazine	Herbicide

This is a long list of chemicals detected in the comb samples studied.

Replacing comb in hives is another way to help bees survive.



One way is to develop a plan to mark frames with the year they are installed into a colony rather than when built. Every five years, frames could be removed and replaced. A good plan might include replacing two frames in each brood box every year. It might be a good idea to replace honey frames more often. Honey itself can absorb contaminants and studies clearly indicate that honey produced in dark comb darkens the color of honey extracted from them.