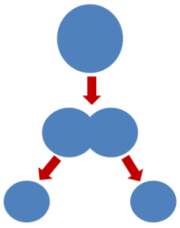
"A swarm in May is worth a load of hay.
A swarm in June is worth a silver spoon.
A swarm in July isn't worth a fly."

— English proverb

Round bale of hay: $35 (NC Agricultural Review classified ads)
Silver spoon: $29.99 (Amazon.com)
House fly pupae: $12.99/1,000 (1.3 cents each) (Joshsfrogs.com)

Here is something to think about: Do we keep honey bees? Or do we keep honey bee *colonies*? There is a difference. Can an individual honey bee survive for very long on its own? Can an individual queen honey bee start a new colony, the way a queen bumble bee or queen yellow jacket does? No, honey bees have evolved in their socialization to the extent that they must be part of the collective; a single honey bee cannot exist on its own. (Neither can the colony exist for any length of time without its comb, the often-overlooked member of the collective, but that's a topic for another day!) Each individual bee is like the cell of a body, with a specific purpose (which changes as the bee's physiology changes), and when that bee's life has run out, it gets replaced. A colony is an organism in itself, made up of other organisms… it is a *super-organism*.

So how do honey bees reproduce? If you said that queens lay eggs that grow into male or female bees, that isn't really the point. The reproduction of individual bees is inconsequential to the big picture. As mentioned, queens laying eggs is analogous to a human body growing new cells. The colony, on the other hand, makes more colonies (more super-organisms) by fission, similar to the way an amoeba reproduces. We call this swarming.



Honey bee colonies reproduce by fission, not by "normal" sexual reproduction.

The perfect swarm: shoulder height and within reach of an electrical outlet for a bee vac!

This is all very fundamental but it is important for beekeepers to truly understand it. Swarming is colony sex. All living creatures have an innate, irresistible compulsion to reproduce; if their predecessors hadn't had that urge, they wouldn't be here. For honey bee colonies, swarming isn't only natural, it is a biological imperative. Beekeepers can try to fight it but it is an uphill battle.

One thing that is extremely important for beekeepers to realize is that once we are able to observe that swarming is eminent, the colony has long since made up its mind that it is going to happen. If you notice one day that your neighbor's yard has a For Sale sign in it, knocking the sign down probably won't deter your neighbor from moving. The decision to leave was made a while ago and the plan is well underway.

What does planning to swarm look like? The entire process has several stages.

Stage One

With bountiful spring resources, a colony rapidly grows in population. Lots of bees crowd the brood nest. The queen has trouble moving around easily. Her "queen substance" is spread thin among all the bees. The pheromone produced by her tarsal glands (on her feet), which inhibits the production of swarm cells, doesn't extend to the edges of the nest.

There is a lot of brood and therefore a lot of brood pheromone. This indicates that the

colony does have a strong, viable queen, so the colony "knows" to go into swarm mode rather than queen-replacement mode.

Academic studies have suggested various theories for what truly initiates swarming and the conclusions often disagree. All that we really know for sure is that at some point, the triggers for swarm-preparation are met, whatever those triggers may be.

In my bee yard, this is what I see: Colonies with second-year queens have sex on their brain, just as teenage kids do. They are going to swarm… that's what they are made for. Crowding doesn't seem to be requirement.

The first sign that my colonies are in Sex Mode is they'll make a very large batch of drones. In colony sex, drones count too, just as human sons are just as useful for spreading your family's genetics as daughters are.

(Note that this large flush of drones is not created to mate with the colony's own virgin queen. To reduce the chance of inbreeding, neither queens nor drones tend to travel to Drone Congregation Areas (DCAs) in the immediate vicinity of their home apiary. Studies have shown that queens fly to DCAs a mile or so away, whereas drones typically end up over three miles away. And since it is common for drones to drift from hive to hive and DCA to DCA, queens often mate with drones that originated quite a distance from the queen's home.[1,2])

After this big wave, drone production drops off dramatically. In my bee yard, that's a visual sign that the colony is going to swarm within a few weeks, so look out! Now the workers increase feeding of the queen and she focuses on completely filling the brood nest with worker eggs. (This begs the question: is a crowded brood nest a trigger for the initiation of swarming preparations or an early sign that those preparations are already in progress? Or both, or neither, depending on the situation? Or something else entirely?)

By the time you see a capped queen cell, there is a good chance that a swarm has already departed with the original Mother Queen.

Workers make queen cups. These are cells shaped like acorn caps that don't yet have an egg in them. Unfortunately production of queen cups is a very unreliable predictor of swarming intentions. Many colonies will make cups as if for practice, only to tear them down later. Others seem to like having queen cups around "just in case". So although the production of queen cups is a sign of impending swarming, it also is often a sign of nothing at all.

Stage Two

Workers begin constructing many swarm cells (queen cells that have actual eggs in them). They also put the queen on a diet and exercise regimen, reducing her feeding and harassing her to keep her constantly moving. This makes her cut down on egg-laying, reduces her weight and gets her fit for flying.

Scout bees begin to search for nesting sites.

Worker bees begin gorging on honey, to be ready to go when the time comes. They do this for about ten days prior to departure. They'll load up on honey equal to about 40% of their

[1] Joseph R. Coelho, "The flight characteristics of drones in relation to mating", *BeeScience*, Vol. 4 No. 1, p 21

[2] Ruttner F. and H. Ruttner. 1966. "Untersuchungen ber die Flugaktivitt und das Paarungsverhalten der Drohnen 3 Flugwiete und Flugrichtung der Drohnen", *Zeitschrift fur Beinenforschung* 8:332-354.

body weight.[3]

Stage Three

The first queen cells are capped. Once that is done, the swarm can leave at any time; there are no more preparations to be made.

Workers agitate their nest-mates to get them ready for departure. What starts as a low roar rises higher and higher in volume until half or more of the colony rushes out en mass with the old Mother Queen. In my bee yard, this typically happens between 10:00 am and 2:00 pm on a nice sunny day.

The air in front of the hive is filled with a frenzied flurry of confused and excited insects, looking a bit like a giant out-of-control popcorn popper has exploded. This looks ominous and can be a bit scary for Normal People. But in fact the bees are quite gentle, focused on figuring out "the plan" without concern for anything else.

Within a few minutes, the swirling flurry will begin to contract. It soon collects it a large mass on a branch, fencepost or other convenient feature. From this staging area scouting for sites begins in earnest. Returning scouts advertise their finds with enthusiastic dances in an attempt to recruit other scouts to investigate their choice. Eventually one site becomes the overall favorite. A cue signals them to depart in one coordinated motion, and they swoop off to their new home. Say bye-bye to 50 to 60% of your colony's bees! In my bee yard, this "deciding where to go" step takes anywhere between 30 minutes and three days, so if you see a swarm, collect it as soon as possible!

Bad weather will cause a delay in the swarm's departure. If there is a stretch of rainy, dreary weather during peak swarm season, you can usually bet that a swarm will depart on the first sunny day that comes along. So watching the weather forecast can increase your chance of being at the right place at the right time and retrieving the swarm.

[3] Mark L. Winston, The Biology of the Honey Bee (Cambridge, MA: Harvard University Press, 1987), Chapter 7

Stage Four

The Mother Colony is now semi-queenless. A new queen is under development but there is no egg-laying occurring. The new regent won't emerge until a week after her queen cell was capped (16 days after the egg was laid).

The first virgin queen to emerge may:

1. kill her queen-sisters still in their cells
2. fight to the death with her emerged queen-sisters
3. be kept separated from queen-sisters and, after a few days, take off with an after-swarm

It is the colony, not the queen, that determines what she does. The workers can spare the queen-sisters by confining them in their cells and herding the first virgin away from them. If the original population is large, the colony may "choose" to swarm a second time with the virgin queen as the swarm's matriarch. The colony can even do this a third time or more. After-swarming is really bad for the beekeeper – each swarm leaves the home colony with fewer and fewer resources. It isn't great for the issuing swarms either. Because they are progressively smaller and smaller, their already-slim chance of success is greatly reduced. Despite what some people may think, bees don't always do the smart thing!

Stage Five

In the original Mother Colony, the new virgin queen's wings harden so that she can fly. She generally strengthens and matures.

Several days after emergence, she goes on her first mating flight. Virgins will go on several mating flights over two or three days, ultimately mating with one to two dozen (or more) drones. She must mate within about two weeks of emergence or she'll be unable to produce fertilized brood. She stores the living sperm in a special sac called a spermatheca for her entire life, never mating again.

After a few days, she begins laying eggs. She never again leaves the hive unless as part of a swarm.

Note that this is tricky time for the

beekeeper. There will be about a two-week period where there will be no queen cells, no eggs or brood and no obvious sign of a queen. Virgin queens are smaller, faster and more shy than fat, laying queens. They are difficult to find. Inexperienced beekeepers, as well as many experienced ones, will incorrectly assume that the colony is queenless and will futilely attempt to introduce a new store-bought queen into the colony. This is a waste of money and a waste of a perfectly good queen, and it can spiral into disaster. Because they already have a perfectly good, albeit virgin, queen, the colony will kill any new queens that are introduced. See April 2014's "I Need to Buy a Queen! Or Do I?" for more on this topic.

Prognosis

Swarming essentially involves ripping a super-organism into two parts and then each of the two parts must grow back into a complete super-organism in its own right. Whether the left-behind Mother Colony and the swarm can successfully recover from this somewhat violent procedure depends on several factors:

1. The time of year that the swarm is issued. This is the basis of the old proverb about "A swarm in May…" (which should be shifted in our region to start in April, but that messes up the rhyme).
    - How much time is left in the season to rebuild the population of both the Mother Colony and the swarm, and build new comb for the swarm?
    - How many environmental resources are available? Are there enough nectar- and pollen-producing plants blooming to feed the growing bee population and to store surplus for coming dearths? Does the ambient temperature allow for foraging?
2. Size of the swarm / size of the Mother Colony
3. Lots of luck

Academic studies have shown that very few swarms, fewer than 20%, live long enough to survive their first winter. They should have stayed at home so that we could take great care of them! Our practical concern is for the recovering Mother Colony. In addition to the factors listed above, its prognosis depends on:

1. The successful emergence, mating and commencement of egg-laying of the virgin queen. Many things can go wrong. Was she damaged in a fight with a queen-sister? Is it the right time of year to find plenty of drones in the DCAs? Was the weather cooperative for making mating flights within the necessary time window? Did the queen get eaten by a hungry blue jay as she was returning from a mating flight? Did the queen return to the right hive or was she killed when she tried to enter the wrong one?
2. Whether the beekeeper messes things up. Did the beekeeper fail to find eggs or brood in the hive and wrongly think the colony was queenless? Did the beekeeper cavalierly cut out every queen cell after the old queen had already departed, or after swarming plans had passed the point of no return?

What can we do?

An article about swarming should include some sage advice about how to deter it. But as I mentioned earlier, swarming is a fundamental part of the super-organism's very reason for existence, and preventing it is a hard nut to crack. C.C. Miller wrote:

> "If a colony disposed to swarm should be blown up with dynamite, it would probably not swarm again, but its usefulness as a honey-gathering institution would be somewhat impaired. Swarming might also be prevented by means of such character as to involve an amount of trouble that would make it unprofitable; or it might be prevented in such a way as to have a very unprofitable effect upon the honey-crop. The thing I am after is profitable prevention."[4]

[4] C.C. Miller, Fifty Years Among the Bees (Medina, Ohio: A.I. Root Company, 1911).

For me, I have only found one, maybe two, methods that seem to sort of work with respect to swarm prevention (or swarm-damage mitigation) and that also suit my management style.

First, propensity to swarm is a genetic trait. It is possible to have honey bees that simply don't choose to swarm. One of my very first colonies kept the same queen (i.e. didn't swarm) for four years. But she's long dead now, and the colonies I currently own seem to approach swarming with Olympic-level enthusiasm. I'm not adept at genetic engineering, but if any of my readers are, can you please tweak some honey bee genes and give me non-swarmers again?

Short of being lucky enough to have non-swarmers, the other technique that I commonly practice doesn't technically thwart the swarming impulse; it just points it in a much less harmful direction. If I find a colony that shows signs of impending swarming (such as queen cells with eggs), I immediately make a split. I take the old queen and move her, along with a few frames of brood and stores, to a hive on a new stand in my apiary. I'm extremely careful not to move any queen cells with this split or else the split may very well swarm. Note that it is totally unnecessary to move this split some arbitrary distance from the original site. The old foragers will return to their familiar home. But most of the bees are house bees who have never flown and they will stay in the new box.

In the left-behind Mother Colony, I remove all but a couple of queen cells. This preserves the means for the colony to replace the old Mother Queen but does not leave enough virgins for them to consider swarming with a virgin queen.

With a greatly reduced population and now living in a new location, hopefully the bees in the new split will "think" that they have already swarmed. Likewise, the old Mother Colony has lost its original queen and has the resources to make a new one, just like in a natural swarm. However I, not the colony, am now controlling how large of a population remains in the Mother Colony. If the original colony was very large and I remove relatively few of the bees and soon-to-emerge brood, I can still get a honey crop from that colony. It may not be as large a crop as if they hadn't chosen to swarm to begin with, but "something" is a whole lot better than "nothing." Plus I now have a new colony to make up for any losses I may have during the year.

I'm sure that you have your own tricks for dealing with a colony's swarming impulse. If you've come across something that reliably works and doesn't, in C.C. Miller's words, "involve an amount of trouble that would make it unprofitable," please let me know!

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