

# The Not-So-Lazy Drones

There's much to be said about the male of the species.

Jennifer Berry

The drone, a.k.a. the “idler” or “lazy worker,” with his large eyes (all the better to see her with), robust thorax (all the better to fly to her with) and stout abdomen (all the better to mate with) is nothing more than flying gametes (sperm cells). Developed from an unfertilized egg, the drone has only 16 chromosomes, half of what the queen mother and each of the workers have. The drone's only mission in life is to mate with a queen and pass on those alleles. But, back at the hive, the drone is basically a lazy, no good for nuthin', ne'er-do-well. He doesn't forage, clean, help in the nursery, build comb, polish cells, make honey or defend the hive. Hence, many beekeepers don't want them around and even take actions to keep their numbers down. Yet drones are an integral piece of the equation for the queen producer, specifically, as well as the health and perpetuation of the species, on the grand scale. Before we explore the wonderful world of the drone, let me first tell you about a funny thing that happened on the way to the apiary . . .

This Spring our lab set up a research project consisting of 200 full-sized colonies. The lab's existing bees were already involved in other projects. So, thanks to Bob Binnie and Ron Kirkland, we purchased 200 additional top-notch nucs. To pick them up, we had to drive about 2.5 hours south of the Bee Lab to the small town of Unadilla, GA. It's no big deal, (insert sarcastic tone here), really! I love to move bees, especially at night. Here you are with trucks and trailers, loaded down with thousands of pounds of bees and equipment driving down a windy, dark, two-lane country road, void of cell phone signals yet littered with deer, raccoons, ground hogs, foxes, bobcat, squirrels, unidentifiable critters, and possums, just waiting to jump out into the road at every turn. Did I mention deer? By 2:00 a.m., you start jerking the wheel ever so slightly as you approach a tan-colored mailbox or clump of grass illuminated by the headlights, which, in your exhausted state, you see as a 400-pound buck about to leap out in front of your overloaded truck.

But before this wonderful journey began, and the

trucks loaded, the crew needed sustenance. After much debate, and several calls back and forth between the two trucks, it was decided that Chic-fil-A was the place to go. Oh, joy! I have nothing against the cows holding up the “Eat More Chicken” signs, but I was hoping for something not in the fast food category. So, we pull in, get out, and begin to trek across the parking lot when someone sees a dead drone on the ground. “Isn't it strange to see a drone

out here in the middle of this overgrown, crowded, noisy, polluted, no-tree-in-sight interstate exit.” You know the kind, peppered with fast food joints, gas stations, overpriced hotels and the proverbial Cracker Barrel.

As we took additional steps, more drones were discovered. “Oh look. There's one. And here's another one right here. They're all over the parking lot!” We look at each other wanting to say, “what the????” When all together, we looked up, scanning the skies, and noticed the black, buzzing mass just to the right of the Chic-fil-A sign. And this is no normal side of the road sign either, but one of those, really tall, huge signs that you can see for a mile away while driving down the interstate. It's our first drone congregation area, a.k.a. DCA. Since we were ill equipped (in other words no high powered telephoto lens just our iPhone cameras), there were no pictures to document our claim of the first DCA next to a Chic-fil-A sign, but there were five witnesses.

And “How did we determine it was not a swarm without the aid of binoculars,” you ask? We determined this by the fact that there were only dead drones on the ground, (no workers), and some of the drones had expelled their endophallus, (evidence they had mated).

Mating in the honey bee world is not a simple task and is even down right deadly. At about a week old, virgin queens fly from the protection of their hive into the air in search of DCAs. That's right. It's the drones that congregate together in large numbers and not the queens. The queens seek out the drones. This makes sense, proportionally speaking, since there are more drones present in a hive than queens. Hence “he” is not as “precious.”





*One way to make sure you have enough drones is to use drone comb. This green plastic drone comb frame makes it easy to see drone production.*

A normal colony will produce 5,000 to 20,000 drones as compared to around 10 queens, which roughly works out to be about 1,000 drones per queen. And, out of those thousands of drones, only a dozen or so will actually have the privilege of passing on their inheritance. So the drones are, shall we say, more expendable than the queen and drones flying in DCAs are extremely vulnerable to a number of predators. Just imagine being a bird and stumbling into a DCA. It would be like hitting the jackpot; all those tasty little morsels buzzing about just beggin' to be dinner.

DCAs are aerial zones, which remain geographically constant day to day and year to year. Why these areas are chosen and how they orientate to them year after year, no one completely understands. However, there are theories. One idea is physical characteristics such as an open field lined with trees, which provide a contrasting horizon next to a bright sky. It has been suggested that flowing water above or below ground may be an attractant as well. It is also believed that pheromones play an important role in assembling drones in an area and keeping them cohesive.

Drones take off from their hive in the afternoon, locate a DCA, fly around, and wait for the illustrious virgin queen to arrive. But, all that flying wears them out. So, occasionally they will take breaks and have been observed resting on vegetation in the vicinity of a DCA. However, once their energy stores have been completely depleted, they must return home in order to refuel. Depending on the weather, drones will make several trips a day, back and forth to the DCA. Anywhere from a few hundred to thousands of drones from different colonies will gather together. The boundaries of a DCA range from around 30-200 m in diameter and 10-40 m above the ground. Now for those rebellious queens, who won't soar inside these DCA parameters will be ignored by the drones. Similar behavior is witnessed inside the colony as virgin queens and drones rub elbows, but mating never takes place. Only in flight will mating occur, which again in the grand Darwinian scheme of things, makes sense.

Virgin queens and drones from the same colony are closely related, so mating in the hive would quickly amplify inbreeding. By leaving the hive and traveling a distance away the chance of encountering different drones



*A colony will put drones wherever they please, making it difficult to measure drone production.*

from different lineages is increased. Hence, increasing the fitness and survival probability of the species. Plus physically, it would be impossible for the drone to mate while on a solid surface.

As the virgin flies into a DCA she releases pheromones that attract the drones to her. And as she flies through the air with the greatest of ease, drones form a "drone comet" consisting of a multitude of eager males flying at top speed closely behind. One by one drones will catch the queen from behind, mount her and copulate while they streak through a DCA. Queens do this over several days or even weeks. When mating occurs, the drone everts his endophallus into the queen's sting chamber and then flips backward forcing the semen into this chamber ending up in her oviduct. The drone's abdomen literally explodes during this five-second mating process resulting in his sacrificial death.

Virgin queens will continue to mate until their spermatheca has reached the maximum capacity, which is roughly 5.3-5.7 million sperm. Given that each drone ejaculate contains anywhere from 87 to 200 million sperm, only a small percentage of the sperm from each drone actually makes it to the spermatheca. Most is passed back out into the sting chamber and lost. Yet, due to sperm migration and mixing, each drone mating with the queen (17-24 on average) has a fairly equal representation of its genetic contribution in the spermatheca.

The term "polyandry" comes to mind at this point. Polyandry, in the bee world, means multiple matings. Polyandry in the human world is defined as a woman with many husbands. But that's another topic for a different time and magazine (wink!). So why is polyandry important to bees?

Due to the fact that sperm from a variety of drones is readily mixed, there are different patriline simultaneously represented in a single colony. Recent studies have found these multiple patriline within colonies do indeed vary in their response to certain pests and pathogens, each of which may catastrophically affect the colony. Much like throwing out a wide net as opposed to a single line and hook, the more drones with whom a queen has mated, the greater chances are that she may capture

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those rare alleles that may just provide resistance to pests or diseases.

By mating with numerous drones the collective sperm is genetically more diverse, which offers variation among the female progeny, which in turn may increase the overall fitness of the hive or ability to survive. With genetic variation, organisms are better adapted to changes in their environment. The ability to tolerate certain infections or infestations for instance reduces the potential, for catastrophic threats posed by pests or pathogens to the colony's survival and reproduction.

Good queen producers (and feral colonies) need a vast number along with genetically different drones during the mating season to ensure queens are not only properly mated but are carrying as many of those different patriline as possible.

So the next time you look upon that drone lazing about with disdain, try not to be too judgmental of the little guy. He plays an important role, and will lay down his life for that rare possibility that his legacy will carry on, from generation to generation, into the future.

Side note. As I sit here writing this article I'm closing on the sale of my house tomorrow, and have just started building a barn/apartment (it's been a four-year process). So I want to thank Philip Quinn, our lab technician, for his superb editing of my grammatically incorrect article. Something he has helped me with numerous times in the past.

See ya! **BC**

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