Bee swarms follow high-speed 'streaker' bees to find a new nest

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It's one of the hallmarks of spring: a swarm of bees on the move. But how a swarm locates a new nest site when less than 5% of the community know the way remains a mystery. Curious to find out how swarms cooperate and are guided to their new homes, Tom Seeley, a neurobiologist from Cornell University, and engineers Kevin Schultz and Kevin Passino from The Ohio State University teamed up to find out how swarms are guided to their new home and publish their findings on October 3rd 2008 in *The Journal of Experimental Biology*.

According to Schultz there are two theories on how swarms find the way. In the 'subtle guide' theory, a small number of scout bees, which had been involved in selecting the new nest site, guide the swarm by flying unobtrusively in its midst; near neighbours adjust their flight path to avoid colliding with the guides while more distant insects align themselves to the guides' general direction. In the 'streaker bee' hypothesis, bees follow a few conspicuous guides that fly through the top half of the swarm at high speed.

Schultz explains that Seeley already had still photographs of the streaks left by high-speed bees flying through a swarm's upper layers, but what Seeley needed was movie footage of a swarm on the move to see if the swarm was following high-velocity streakers or being unobtrusively directed by guides. Passino and Seeley decided to film swarming bees with high-definition movie cameras to find out how they were directed to their final destination.

But filming diffuse swarms spread along a 12·m length with each individual on her own apparently random course is easier said than done. For a start you have to locate your camera somewhere along the swarm's flight path, which is impossible to predict in most environments. The team overcame this problem by relocating to Appledore Island, which has virtually no high vegetation for swarms to settle on. By transporting large colonies of bees, complete with queen, to the island, the team could get the insects to swarm from a stake to the only available nesting site; a comfortable nesting box. Situating the camera on the most direct route between the two sites, the team successfully filmed several swarms' chaotic progress at high resolution.

Back in Passino's Ohio lab, Schultz began the painstaking task of analysing over 3500 frames from a swarm fly-by to build up a picture of the insects' flight directions and vertical position. After months of bee-clicking, Schultz was able to find patterns in the insects' progress. For example, bees in the top of the swarm tended to fly faster and generally aimed towards the nest, with bees concentrated in the middle third of the top layer showing the strongest preference to head towards the nest.

Schultz also admits that he was surprised at how random the bees' trajectories were in the bottom half of the swarm, 'they were going in every direction,' he says, but the bees that were flying towards the new nest generally flew faster than bees that were heading in other directions; they appeared to latch onto the high-speed streakers. All of which suggests that the swarm was following high-speed streaker bees to their new location.

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