

Worker or queen? Harvester ant moms set daughters' fates

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When it comes to deciding what harvester ant daughters will be when they grow up, mother queens hold considerable sway, according to a new study published online on February 14th in *Current Biology*, a publication of Cell Press. The researchers report evidence that eggs are predetermined to become workers or queens from the moment they are laid.

“In honeybees, food determines fate,” said Tanja Schwander of Simon Fraser University in Canada. Earlier studies showed that honeybee larvae had the capacity to become either workers or queens, depending upon what the young insects ate.

“Although it had never been shown experimentally, ants had been assumed to be more or less the same,” she added. “That’s the reason it was surprising to find a strong effect of mother queens.”

In nature, *Pogonomyrmex* harvester ants live in colonies that can be 10,000 to 12,000 strong, with each colony started by a single mother queen. Although workers and queens are all female, they differ considerably both anatomically and physiologically, said Schwander, who conducted most of the work while at the University of Lausanne in Switzerland.

Queens also have wings at the beginning of their life, which allow them to fly off and mate. Once mated, they settle down, lose their wings, and produce working daughters who will tend later broods. In early spring,

the queens produce new queens and males. The males' only job is to mate, after which they die.

Scientists had thought that a daughter's "caste," either worker or queen, was determined by a developmental switch during the larval stage controlled by nutritional and other environmental factors, meaning that eggs laid by females had the capacity to go either way. But Schwander's team wanted to know whether queens had a say.

The trick to revealing mom's role in the fate of their daughters, Schwander said, was to physically separate the place where the eggs were laid from where they were raised in the laboratory. By collecting eggs from one environment and transferring them to another, they disentangled the factors influencing eggs from those that act later.

They found that new queens are produced only from eggs laid by queens exposed to cold, as would typically occur during overwintering. Moreover, there was a strong age effect, with development into queens occurring only in eggs laid by queens that were at least two years old.

Biochemical analyses of eggs further revealed hormonal differences in eggs that developed into queens versus workers. By contrast, the researchers found no significant effect of colony size or the exposure of workers to cold, "suggesting that the trigger for caste differentiation may be largely independent of the quantity and quality of resources provided to larvae during development."

"By allowing a precise timing of queen production, maternal effects on female caste determination may provide benefits in species where queens and males are produced only during a short period of the year," the researchers concluded. "Whether ecdysteroids and/or other hormones may directly affect the pattern of gene expression and be responsible for a developmental switch remains to be investigated."

Regardless of the mechanism used by queens to affect the developmental fate of their eggs, our study, together with the growing evidence of non-environmental factors affecting caste determination in other species, calls for a re-evaluation of the idea that the ant caste system is based solely on nutritional and social effects during the larval stage on gene expression and the developmental pathway of females.”

Source: Cell Press

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