A bee's future as queen or worker may rest with parasitic fly

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(PhysOrg.com) -- Strange things are happening in the lowland tropical forests of Panama and Costa Rica. A tiny parasitic fly is affecting the social behavior of a nocturnal bee, helping to determine which individuals become queens and which become workers.

The finding by researchers from the University of Washington and the Smithsonian Tropical Research Institute is the first documented example of a parasite having a positive affect on the social behavior of its host. This is accomplished by cleptoparasitism – in this case fly larvae stealing food from the developing immature bees.

The researchers found that smaller bees that emerge in a nest are dominated by their mothers. These small bees are more likely to stay and act as helping workers, while larger bees tend to depart and start new nests as egg-laying queens. Bees that emerge from cells, or brood chambers, that also house flies are smaller than their nest mates from fly-free cells. The flies may encourage worker behavior in some bees.

"We often think of parasitism in terms of it affecting an animal's fitness, its survival or its ability to reproduce," said Sean O'Donnell, a UW associate professor of psychology and co-author of the paper appearing in the current issue of the *Journal of Insect Behavior*. "Here the parasite is not living inside another animal, but is still stealing resources from the host.

"We think these fly parasites are not affecting the lifespan of the bees,

and the bees' mothers benefit by having a helper, or worker, stay around to protect the nest, increasing survivability."

O'Donnell and his colleagues studied two closely related tropical social bees, Megalopta genalis and Megalopta ecuadoria, and a family of very small parasitic flies called *Chloropidae*.

The bees are important pollinators of night-blooming plants and the female bees can nest alone or live in small colonies. A colony is typically made up of two to four individuals – a queen and her offspring.

Behavioral observations showed that non-reproductive foragers and guards are significantly smaller than the queen bee in a nest, although the relative size of individual bees varied from nest to nest. Here's where the flies apparently fit in and are affecting the bees' behavior. The bees nest in hollowed twigs and sticks hanging in the tropical understory and the flies flick their eggs into the entrance to the bee nests. Some of these eggs randomly fall into cells, or chambers, prepared by the bees, each to hold a larva and pollen that the larva eats. The cells are then sealed, so if a cell does contain fly eggs the young flies are competing with the bee larva for a limited amount of food.

"There is a natural size variation in bees and this is based in part on the amount of food available in the cell," said O'Donnell. "A fly or flies in a cell reducing the amount of food could be a potentially important factor. It seems that the more flies in a cell the smaller the bee is. The key here is relative body size compared to nest mates. The larger individuals become queens because they are not dominated."

The researchers were able to culture the bees and flies from individual cells and counted as many as 15 of the tiny flies in a single cell. Some cells did not contain flies.

"This study is a counterintuitive take on parasitic infection. It encourages us to look for complicated ecological relationships between different species. Parasitism may encourage sociality in some situations. Here it is promoting social behavior," O'Donnell said.

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