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New research discovers worker bees in 'reproductive class war' with queen

Bee colonies are well known for high levels of cooperation, but new research published in *Molecular Ecology* demonstrates a conflict for reproduction between worker bees and their Queens, leading some workers to selfishly exploit the colony for their own needs.

The study focused on *Melipona scutellaris* a Brazilian species of highly social stingless bees, found throughout the Atlantic rainforest. Colonies contain around 1,500 workers and are headed by one single-mated Queen.

Denise Alves, Dr Tom Wenseleers, and their co-authors carried out a genetic study of nearly 600 males from 45 colonies to discover the parentage of the worker population. Their results showed that 22.89% of *Melipona scutellaris* males are sons of the workers rather than the Queen, demonstrating an on-going conflict for reproduction.

"Surprisingly our results show that over 80% of the worker's sons had genotypes that were incompatible with them being the sons of the present queen," said Alves. "This demonstrates, for the first time, how workers continue this conflict by reproductively parasitizing the next-generation of the workforce for their own selfish benefit."

Worker bees are generally unable to mate, but are capable of laying unfertilized eggs which can develop into male offspring. To assure dominance over reproduction the Queen often selectively eats any worker laid eggs. In some species other workers may eat the eggs of fellow workers in what is known as 'worker policing'.

Even with these barriers there is much to gain for worker bees producing their own offspring, however the benefit is entirely for the individual and can be costly for the colony overall. The team found that workers who reproduce can live as much as three times longer, meaning that reproducing workers have a life expectancy almost matching the Queen herself.

This added life expectancy is thought to be because workers who reproduce do not usually carry out risky tasks such as foraging. However as worker bees who are reproducing are not working, an increase in individual workers who reproduce puts the collective production of the colony in jeopardy, hence a queen-worker conflict over the production of males ensues.

To demonstrate this conflict the team studied the genotypes of worker and queen bees from 45 colonies. If a male carried a genotype not present in either the mother queen or her mate, then it was clear the male was either the son of an invading bee or of a worker who superseded the Queen.

The team found that of 576 males genotyped, 61 (10.59%) could not be assigned to the Queen and were therefore definitely worker's sons. Of these 61, 14 (22.95%) were consistent with being sons of workers of the current queen while 47 (77.05%) were derived from workers derived from a previous, superseded queen .

The team estimates 77.11% of the males were the queen's sons. 4.34% were the sons of the workers derived from the current queen and 18.54% were the sons of workers derived from a previous, superseded queen.

"These results are the first explicit demonstration that conflict over male parentage in insect societies is not just played out between the queen and workers," concludes Alves,

"but shows that the conflict may also spill over from one generation of workers to the other."

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