

Promiscuous queen bees maintain genetic diversity

April 16 2012

By mating with nearly 100 males, queen bees on isolated islands avoid inbreeding and keep colonies healthy.

The results, published in the current issue of [PLoS ONE](#), focused on giant [honey bee](#) colonies on Hainan Island, off the coast of China. Since these bees have long been separated from their continental cousins, it was thought that the island bees would be prime candidates for inbreeding as well as having very different genes, said Zachary Huang, Michigan State University entomologist.

"We believed that the island bees would show evidence of the [founder effect](#), or random [genetic changes](#) in an isolated population, on a unique [sex determination](#) gene from the mainland bees," he said. "At first we were surprised when we couldn't document this effect. Looking at it further, I asked myself, 'Why didn't I think of this before?'"

When compared to bees, humans have a rather simplistic sex-determination process. In females, the two sex-determination [chromosomes](#) are the same, and in males the two chromosomes are different. With bees, however, the combinations of complementary sex determination genes, or CSDs, determine the sex and the societal role of the bees.

One particular gene can have alleles – the "flavor" of [genes](#). In humans, they dictate hair and eye color. In bees, though, they are responsible for creating females (worker bees), fertile males (that mate with the queen)

or infertile males (diploid males which serve no purpose).

The voila moment came once Huang estimated the bees' mating habits and the potential of CSD allele combinations. That's when he understood why he couldn't confirm the founder effect. Keeping the CSD mix diverse is one of the keys to maintaining a healthy hive, he said.

The island queens carry around 40 CSD alleles. Since they mate with nearly 100 males – each also harboring around 40 alleles – the high number of healthy genetic combinations keeps the gene pool diverse. By using natural selection to create healthy offspring, the bees perpetuate a healthy colony.

In comparison, if the island bees adopted the breeding habits of fire ants, with queens mating with a single male, [inbreeding](#) could wreck the off-shore clades or distinct populations of bees. The devastating change would reduce the fitness of the hive, decreasing the female workforce, as well as lowering the number of mating males.

What would be left would be an unhealthy hive with higher numbers of diploid or infertile males, with the same alleles, Huang said.

By extending his research beyond Hainan Island, Huang found evidence that showed that the island wasn't an isolated case.

"We failed to find any clustering of the bees' CSD alleles according to their geographical origin; the Hainan and mainland bees did not form separate clades," said Huang, whose research is supported by MSU AgBioResearch. "Previously published CSD sequences also failed to show any unique clade-forming in the Philippines and Malaysia."

Provided by Michigan State University

Citation: Promiscuous queen bees maintain genetic diversity (2012, April 16) retrieved 26 April 2024 from <https://phys.org/news/2012-04-promiscuous-queen-bees-genetic-diversity.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.