Study settles debate over origins of ants and bees

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Credit: Lilla Frerichs/public domain

Ants and bees – which by all appearances seem so different – are creepy-crawly cousins, according to new research published in a recent issue of *Current Biology*.

The new findings show unequivocally that ants' closest living relatives are a superfamily called Apoidea, which includes bees and some solitary

hunting wasps.

Within the superfamily Apoidea, two subfamilies of hunting wasps that include just over 2,000 species in total are the "sister group" (or closest living relatives) to bees, which includes over 20,000 described species, according to the study.

The study, which used cutting-edge DNA sequencing techniques to take a deep look at the taxonomic relationships among wasps, bees and ants, helps settle an ongoing debate about the origins of ants and bees.

"There has been a long history of studying these questions but now, with the availability of DNA sequencing data, the scope of analysis has grown much larger," said Bryan Danforth, professor of entomology and a co-author of the paper. Michael Branstetter, currently at the USDA Bee Biology and Systematics Laboratory (Logan, Utah) and a former post-doctoral researcher at the Smithsonian Institution's National Museum of Natural History, is the paper's lead author.

"We can now use 1,000 genes when 10 years ago we were using just a few genes," Danforth said.

The study also suggests that when early bees switched from preying on other insects to pollen feeding, the number of bee species exploded compared with their hunting wasp sister group.

"The switch from predatory behavior in hunting wasps to pollen feeding in bees has led to a tenfold increase in diversification. Our findings support the idea that the switch to a vegetarian lifestyle in bees is a really big deal in terms of explaining bee diversity on earth," Danforth said.

Meanwhile, ants share many similar features to their apoid relatives: Ants and most bees build nests; they are central-place foragers (meaning

they return to fixed nest sites after foraging); and they both include social species. All species of ants and about 10 percent of bees show advanced forms of sociality.

"It may be that nest building, central-place foraging and sociality all go together; these may be a suite of traits that have allowed ants to become the dominant insect group in terrestrial habitats and may have allowed bees to become the most important pollinators of flowering plants," Danforth said.

In a collaboration with co-authors Sean Brady, an entomologist at the Smithsonian Institution, and James Pitts, a biologist at Utah State University, the researchers developed probes to uncover regions of wasp, bee and ant genomes that are evolutionarily conserved (DNA sequences that have remained similar or identical across species). Once those regions were identified, the researchers sequenced DNA flanking these core regions where there was more variability. By aligning these genes across species and looking for similarities, the researchers were able to determine evolutionary relationships among the groups of ants, wasps and bees.

The DNA sequencing was done at the Cornell Biotechnology Resource Center.

This study is part of an ongoing project funded by a National Science Foundation grant that will continue to analyze taxonomic relationships across Aculeata (stinging wasps), the infraorder that includes wasps, bees and ants.

More information: Michael G. Branstetter et al. Phylogenomic Insights into the Evolution of Stinging Wasps and the Origins of Ants and Bees, *Current Biology* (2017). DOI: 10.1016/j.cub.2017.03.027

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