

# Genes that may be helping bumblebees adapt to environmental change pinpointed

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Buff-tailed bumblebee. Credit: [Vera Buhl](#)/Wikimedia Commons, CC BY-SA 3.0

Researchers studying bumblebee genomes have identified genes thought to be helping bees overcome environmental challenges, such as climate change.

The study, led by researchers from Queen Mary University of London and Imperial College London, looked at [genome](#) sequences of buff-tailed bumblebees (*Bombus terrestris*)—one of the most widespread European species—to understand how they have been adapting to the dramatic environmental change they have faced in recent evolutionary time.

The team searched the genomes to find which parts had been replaced by newer versions over recent decades—a term researchers call "signatures of selection." They found signs of recent changes to the genome in areas known to be linked to the nervous system and wing development.

The researchers suggest that these genetic changes likely improved the bumblebees' ability to forage further for food in response to increasing habitat fragmentation and changes in climate. The results are published in the journal *Molecular Biology & Evolution*.

Bumblebees and other insects are important natural pollinators of crops and of wildflowers. Recent studies have documented international declines of bees and other pollinators, citing habitat loss, disease, pesticides, and [climate change](#) as contributing factors. However, some of these pollinators, such as *Bombus terrestris* have been doing well, despite changing environmental conditions.

## **Genomic advances**

Co-author of this study Dr. Richard Gill, from the Department of Life Sciences (Silwood Park) at Imperial, said: "Advances in genomic techniques are now providing us with unprecedented insight into how previously overlooked species are responding to environmental change.

"Understanding responses of insect pollinators like bees was previously reliant on recorded sightings, but these are not always reliable due to

sparse historic records and unstandardised methods. The genome, however, provides an effective diary of how populations are responding.

"By studying these genetic changes, we can better understand why some species are doing better than others and which environmental pressures are the primary culprits, which can inform mitigation strategies."

Lead author of the study Dr. Yannick Wurm, from Queen Mary University of London and the Alan Turing Institute, said: "We found signatures of recent adaptation in genes throughout the bumblebee genome, including for genes involved in the nervous system and in wing development."

"Simultaneously analyzing many genomes of the buff-tailed bumblebee sheds new light on the health of this species. This species is doing well, and we found that most of the genome harbors extensive genetic diversity and the ability to use it. These traits will support this species in continuing to adapt to the challenges it faces."

## **Tools for safeguarding**

Interestingly, the researchers also uncovered some unusual features of the [bumblebee](#) genome, including a region containing 53 genes that lacked the diversity found in the rest of the genome.

Dr. Thomas Colgan, the first author of the study from Queen Mary University of London, said: "In contrast to the high genetic diversity in most of the genome, we found a gene-rich region with the opposite pattern: extremely low diversity in bumblebees and in their relatives, the honeybees.

"We don't fully know the evolutionary reasons for the pattern observed in this region of the genome, nor how it may impact the ability of the

species to adapt."

The findings provide important insights into the ability of a key pollinator to adapt and highlight the benefit of genomic approaches for understanding the genetic health of wild populations. The researchers suggest that this type of approach could help develop tools for safeguarding beneficial insects important for ecosystem stability, biodiversity maintenance and crop productivity.

Dr. Wurm added: "The UK hosts more than 1,500 beneficial pollinator species, including many species of bees. Applying the genomic approach developed here to other pollinators can help identify those [species](#) most at risk and inform the development of custom-tailored conservation and mitigation strategies."

**More information:** Thomas J Colgan et al, Genomic signatures of recent adaptation in a wild bumblebee, *Molecular Biology and Evolution* (2022). [DOI: 10.1093/molbev/msab366](https://doi.org/10.1093/molbev/msab366)

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