Fly genomes show natural selection and return to Africa

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The Drosophila melanogaster fruit fly is returning to Africa and showing new insights into the forces that shape genetic variation. Credit: Andre Karwath/Creative Commons license

(Phys.org)—When ancestral humans walked out of Africa tens of thousands of years ago, Drosophila melanogaster fruit flies came along with them. Now the fruit flies, widely used for genetics research, are returning to Africa and establishing new populations alongside flies that never left—offering new insights into the forces that shape genetic variation.

That's one of the findings from two new papers published this month by researchers at the University of California, Davis, and their colleagues that describe the genomes of almost 200 strains of the tiny flies.

The work reveals strong evidence of pervasive natural selection throughout the D. melanogaster genome, said Charles Langley, professor of genetics in the Department of Evolution and Ecology at UC Davis and an author on both papers. That is in striking contrast with what is known of the human genome, which shows comparatively little evidence of adaptation over the last 100,000 years.

The overall aim of the research is to better understand the forces that shape genetic variation, Langley said. Human geneticists are working to sequence a thousand human genomes to get at the same issue. The knowledge from studying fly genetics has and will help in that effort, he said.

"Most of the theory and statistical methods in human genetics were originally motivated by studies of flies, because they're easier and faster to work with," Langley said. "Model organisms like these play a critical role in developing tools and ideas."

The first paper, published Oct. 1 in the journal *Genetics*, reports the genomes of 37 strains of Drosophila collected in Raleigh, N.C., and six strains from the sub-Saharan nation of Malawi. The other paper, to be published in Public Library of Science *Genetics* and currently available online as a preprint, describes the genomes of 139 fly strains covering 22 African and one European population.

Drosophila melanogaster, like humans, originated in Africa, and that's where they show the most genetic diversity—just as humans do. The flies are thought to have appeared in Europe about 50,000 years ago, along with modern humans. On the way, both humans and flies squeezed through genetic bottlenecks that reduced the diversity in the population. Over generations, different fly strains evolved quite specialized niches—such as a fondness for colonizing breweries, for example.

But the African fly genomes show that just in the past couple of decades, flies similar to those found in Europe or the U.S. have established populations back in Africa, often in new environments such as urban and industrial developments. For example, where modern breweries and bottled beer have displaced traditional African brewing, "Europeanized" brewery flies have followed.

The spread of those "European" genes is more rapid than if it were occurring by random processes, the researchers write.

"It may be that urbanization and development favor the more 'European' flies," Langley said.

Provided by UC Davis