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How both macho and meek persist

Vole study shows one way that evolution preserves diversity

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ENLARGE

A female bank vole — a species with underlying genetic conflicts between the sexes — appears unreceptive to a male's advances. Courtesy of M. Mokkonen

Small rodents called voles have their own battles of the sexes over macho traits. And it turns out that dominant voles don't always come out on top, which may explain one way a species maintains genetic diversity.

Among European rodents called bank voles (*Myodes glareolus),* dominant males readily trounce meeker ones in disputes over rights to court females, explains Mikael Mokkonen of the University of Jyväskylä in Finland. But the genetic mix underlying these supercharged males doesn't work well when females inherit it. Sisters of the truculent top voles tend to have small litters of pups, he and his colleagues confirm in the Nov. 18 *Science*.

"You can think of sexual conflict as a tug-of-war over a trait value because what's optimal for males is not optimal for females," Mokkonen says.

Researchers have proposed that the evolutionary push and pull of such conflicts — favoring a dominant genetic mix at times in males but disfavoring it in females — keeps variety in a population. That possibility has become a hot topic in recent years as one possible solution for a central puzzle in biology: "If selection strongly favors some gene or some trait, why do we see so much variation in natural populations?" says evolutionary biologist Robert Cox of the University of Virginia, who studies male-female issues in lizards.

For bank voles, sexual conflict by itself isn't enough to preserve variations indefinitely, Mokkonen and his colleagues conclude. Warring sides probably aren't perfectly balanced, and the researchers' computer simulations found that genetic variation dwindles over the course of generations.

Adding another evolutionary factor to the simulations did preserve vole variation. This fickle, hard-to-demonstrate evolutionary effect, called negative frequency-dependent selection, favors a trait only when it's rare.

This effect showed up in field experiments when Mokkonen and his colleagues set clusters of voles outdoors. In groups with mostly low-dominance males and females, a lone dominant male sired many pups. But when surrounded by mostly high-dominance males and females, macho males faltered, fathering only about half as many pups as their counterparts in the other mix.

Perhaps the dominant-type voles spent so much time and energy competing that they did less actual courting and reproducing, Mokkonen speculates.

With these data, the researchers identified the rarity effect among voles: It favors the high-dominance genetic type when rare, but damps it down when common. So if high-dominance lineages shrink enough, they'll become scarce and get a rebound boost. "It's potentially a very powerful mechanism for maintaining genetic variation," Mokkonen says.

Evolutionary benefits for rare traits have turned up in plants and invertebrates, but voles mark the first experimental demonstration in mammals, he says.

What especially appeals to Ryan Calsbeek of Dartmouth College about this outcome is that it depends not just on an individual vole but on the neighbors. The study "provides beautiful insight into the role that social interactions can have in the maintenance of diversity," he says.

SUGGESTED READING :

- M. Mokkonen et al. Sexual antagonism for testosterone maintains multiple mating behaviour. Journal of Animal Ecology. doi: 10.1111/j.1365-2656.2011.01903.x

CITATIONS & REFERENCES :

- M. Mokkonen et al. Negative frequency-dependent selection of sexually anatagonistic alleles in Myodes glareolus. Science, Vol. 334, November 18, 2011, p. 972. doi: 10.1126/science.1208708