Gene exchange common among sex-manipulating bacteria

March 25 2009

Certain bacteria have learned to manipulate the proportion of females and males in insect populations. Now Uppsala University researchers have mapped the entire genome of a bacterium that infects a close relative of the fruit fly. The findings, published in PNAS, reveal extremely high frequencies of gene exchange within this group of bacteria. In the future it is hoped that it will be possible to use sex-manipulating bacteria as environmentally friendly pesticides against harmful insects.

Bacteria belonging to the Wolbachia group are adapted to invertebrate animals such as insects, spiders, scorpions, and worms. These bacteria spread via the female's eggs from one generation to the next and manipulate the sex quotas among the infected animals so that more females are produced in the population. Mechanically speaking, the bacteria convert genetic males into females or kill male embryos that are then eaten by their sisters or make females lay unfertilized eggs that all become females. However, what happens most commonly is that the males cannot reproduce with non-infected females. This gives the infected females a great advantage, and the infection spreads rapidly among the population.

The studies of the whole genome have shown that these bacteria carry genes that are common among higher organisms, but rare among other bacteria. The scientists believe that the bacteria have stolen these genes from the genome in the host cell and that they now use them to manipulate the sex quotas among the insects.

"With the help of viruses, these bacteria exchange genes with each other, which leads to a rapid dissemination of genes that are thought to be important for sex manipulation," says Lisa Klasson, one of the researchers behind the study.

The researchers have shown that the genomes of these bacteria are evolutionary mosaics, with DNA pieces from many closely related bacteria. The effect is that each gene has its own evolutionary history and that the potential for variation is infinite.

"It's fascinating that bacteria, with only 1,000 genes, can control complicated developmental processes and behaviors in insects," says Siv Andersson.

By mapping how the genes in these bacteria change over time and figuring out the mechanisms behind sex manipulation, scientists will be able to lay a foundation for finding new pesticides for insects, based on nature's own principles.

More information: Read the article in PNAS.

Source: Uppsala University