Antibiotic disrupts termite microflora, reducing fertility, longevity

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The microbial flora of the termite gut are necessary both for cellulose digestion and normal reproduction, and feeding the insects antibiotics can interfere in these processes, according to a paper in the July issue of the journal *Applied and Environmental Microbiology*.

“New and effective technologies for the control of social insect pests may be devised as a result of this work,” says corresponding author Rebeca B. Rosengaus of Northeastern University, Boston, MA.

In this study, the researchers fed wood and the antibiotic rifampin to an experimental group of termite queens and kings, while feeding wood and water to a control group. The antibiotic treatment permanently reduced the diversity of the gut microbiota. Although antibiotic-fed queens and kings suffer higher mortality than their control counterparts, the authors do not believe the mortality was due to malnutrition or starvation. Surviving antibiotic-fed queens and kings had reduced rates of oviposition, which resulted in delayed colony growth, and reduced colony fitness. “These results point to the potential for using antibiotics to control termites and/or other insect pests, while reducing the need to attack them with toxic pesticides,” says Rosengaus.

In the paper, the researchers speculate that rifampin reduces fertility and longevity by disrupting mutualistic bacterial partnerships within the hosts. “Given the long coevolutionary history between the gut symbionts and termites, it is likely that these social insects accrue additional benefits from their microbiota that are unrelated to cellulolytic activity,”

they write, noting that in other insects, gut symbionts are known to help in "…detoxification, mediation of disease resistance and immune function, production of volatile compounds that are coopted to function as aggregation or kin recognition pheromones and defensive secretions, and performance of atmospheric nitrogen fixation."

Besides the possibility that the research will lead to methods for curbing termites and other social insect pests, it may illuminate the co-evolutionary history of an ancient relationship, says Rosengaus. "These host-microbial interactions likely influence the evolution of multiple life history traits of hosts, including their longevity, behavior, reproductive biology, immunity, and perhaps even the evolution and maintenance of their sociality," she says.

The work might even have relevance to human physiology, says Rosengaus. Hundreds of species of microbe inhabit the human gut, and researchers are beginning to show how the compounds these microbes produce influence our physiology. "Understanding the possible impacts that these microbes have on the physiology of insects—a more tractable animal model—we can make inferences about the multiple roles that human gut microbes have on our physiology," says Rosengaus.

More information: R.B. Rosengaus, et al., 2011. Disruption of the termite gut microbiota and its prolongued consequences for fitness. *Appl. Environ. Micriobiol*. 77:4303-4312

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