

# Slave rebellion widespread in ants

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Slave rebellion: A slavemaker pupa is killed by enslaved host workers of the species *T. longispinosus*. Credit: Alexandra Achenbach

Ants that are held as slaves in nests of other ant species damage their oppressors through acts of sabotage.

Ant researcher Professor Dr. Susanne Foitzik of Johannes Gutenberg University Mainz (JGU) in Germany first observed this "slave rebellion" phenomenon in 2009. According to the latest findings, however, this behavior now appears to be a widespread characteristic that is not limited to isolated occurrences. In fact, in three different populations in the U.S. states of West Virginia, New York, and Ohio, enslaved *Temnothorax longispinosus* workers have been observed to neglect and kill the offspring of their *Protomognathus americanus* slavemakers rather

than care for them. As a result, an average of only 45 percent of the parasite's offspring survived. This presumably reduces the strength of the parasites in the area and thereby increases the chances of survival for the neighboring colonies populated by the slave ants' relatives.

More than half of all [animal species](#) live in parasitic relationships, i.e. they exploit their so-called hosts. From the perspective of [evolutionary history](#), the American slave-making ant *Protomognathus americanus* is an old social parasite that is entirely dependent on other [ant species](#) for its survival. Slave workers have to care for the brood in parasite nests, bring food to their masters and feed them, and even defend the nest.

These ants become slaves when workers from the slave-making [ant colony](#) attack the nests of the [host species](#) *Temnothorax longispinosus*, kill the adult ants, and steal the brood. Back in the masters' nest, which can be located in hollow acorns, nutshells, or twigs, the brood care behavior of the emerging slave workers is exploited to the advantage of the slavemaker species. As Susanne Foitzik and her work group have shown, the enslaved [worker ants](#) feed and clean the larvae, thereby raising the offspring of their social parasite – but only up to a certain point.

"Probably at first the slaves cannot tell that the larvae belong to another species," explains Foitzik. As a result, 95 percent of the brood survives the larval stage. But the situation changes as soon as the larvae pupate. "The pupae, which already look like ants, bear chemical cues on their cuticles that can apparently be detected. We have been able to show that a high fraction of the slavemaker pupae are killed by slave workers." The pupae are either neglected or actively killed by being attacked and torn apart. Several slaves at once may assault a pupa, which is unable to move or defend itself during the pupal stage and is also not protected by a cocoon.

In parasite nests in West Virginia, only 27 percent of the pupae survived, and in the New York colonies, only 49 percent. In Ohio, the survival chances of the American slave-making ant was a bit higher at 58 percent, but this figure is still well below the survival rate of 85 percent for host pupae in their own free-living nests. "The enslaved workers do not directly benefit from the killings because they do not reproduce," explains Susanne Foitzik. But, through the killing of slavemaker offspring, their neighboring relatives – which might very well be the sisters of the worker slaves – indirectly benefit as their chances of survival are increased. Slavemaker colonies damaged by slave rebellions grow slower and smaller slave-making colonies conduct fewer and less destructive slave raids.

The large differences in the death rates in colonies from different regions fits to predictions derived from the geographic mosaic theory of co-evolution. This theory claims that populations differ because they are subjected to different local selection pressures and because they possess different attack or defense traits originated through mutations, which in turn means that evolution can go in different directions in different geographic areas. While the host ants in New York are very aggressive and often successfully thwart slave raid attempts, the hosts in West Virginia profit more from the slave rebellion behavior because, as genetic analyses have shown, the neighboring colonies are more often close relatives to the rebelling slaves.

**More information:** Tobias Pamminger et al., Geographic distribution of the anti-parasite trait "slave rebellion", *Evolutionary Ecology*, June 2012

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