



## ScienceWatch - War and Peace Among Ants

Invasive species are a worldwide ecological problem. They often overwhelm native species and disrupt the ecosystem causing ecological and economical damage. The European starling (*Sternus vulgaris*) and the gypsy moth (*Lymantria dispar*) are two well-known examples of invasives that cause widespread harm. While the attributes of a successful invasive are difficult to pinpoint, it is generally assumed that success occurs because they no longer are subjected to the biological controls of their home range due to changes in external forces such as lack of predation, parasites or competitors. However, a recent study of a successful invasive ant demonstrates that an invader can ensure its success by changing one or another of its fundamental attributes.

The Argentine ant (*Linepithema humile*) is a superb invader. It was first detected in the U. S. in New Orleans in 1891 and by 1907 was well established in California, primarily in coastal regions, riparian woodlands and agricultural areas. In its introduced range it achieves high population densities and dominates huge areas. Once established, it displaces native ant species and negatively impacts on other arthropods. In contrast, Argentine ants in their native range co-exist with other ant species as part of a diverse and species-rich community. A team of ecologists from the University of California at San Diego report that a fundamental change in the behavior of introduced ants may underlie their success. Argentine ants in their native range exhibit a high degree of aggression defending their nests against neighboring conspecific colonies. Colony boundaries are fiercely guarded because the only way a non-reproductive worker can pass on her genes is to insure the success of her closely related queen. Such kin selection is common among social insects and helps explain their apparent altruistic behavior. In contrast, the introduced ants are generally a peaceful lot. Rather than fight with their neighbors they cooperate, ousting competing species and forming vast supercolonies that dominate the region.

How is this change brought about? Writing in the May 23<sup>rd</sup> issue of the Proceedings of the National Academy of Sciences, Neil Tsutsui and colleagues show that a loss of genetic diversity converts the invaders from a group of warring tribes into a highly successful confederation. By combining forces the relatively small (2-3 mm) Argentine ants are able to overwhelm competitors, even those species composed of much larger individuals.

The scientists compared the behavior and genetic diversity of ant colonies in the native (Argentina) and introduced (California) ranges. They quantified aggressive behavior by placing individual workers from each of two nests in a vial and scoring their interaction for ten minutes. Biting and tugging was scored as highly aggressive, while simple touching or avoidance was scored as friendly. An average of 5 - 10 trials were done for each nest pairing and the assay was highly repeatable. Genetic relatedness was determined by collecting DNA from ten to 15 individuals from each nest. Genes located at seven different regions of the genome were examined and the percentage shared by each pair of nests was taken as an indicator of relatedness. The team found that

aggression was typically absent in introduced populations. Even ants from distant nests in the introduced range exhibited little, if any, aggression towards each other. In contrast, a high degree of aggression was common throughout the native range and was seen to increase with greater distance between nests. Not surprisingly, low levels of genetic similarity were found where high levels of aggression were common. Distant nest pairs from Argentina showed low levels of genetic similarity, while those from California exhibited a high degree of genetic relatedness. The evidence indicates that the California ants passed through a "genetic bottleneck". The introduced ants had lost two-thirds of their genetic variability, and that is why they tolerated and even cooperated with ants from other nests.

Fire ants (*Solenopsis invictus*) are another invasive and destructive species that have been highly successful in their introduced range. Native to Brazil, fire ants were imported into Mobile Alabama in the 1930's and now are found in 11 southern states. Here too differences in colony structure exist between native and introduced populations. The introduced fire ants have also gone through a genetic bottleneck that has reduced genetic diversity. This has resulted in reduced intraspecific aggression and allowed the formation of huge nests with several queens. In contrast, one queen per nest is the rule in the native range. Genetic diversity is the raw ingredient that natural selection acts upon so loss of diversity usually has harmful effects. It appears that, at least for now, the ant has converted loss of diversity into a success story.

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