Invasive species can produce 'hotspots of evolutionary novelty,' study shows

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When exotic species invade new territory, they often present a major threat to the other plants and animals living there—that much is clear. But researchers writing in the March 11th issue of Current Biology, a publication of Cell Press, now show that, in addition to their destructive tendencies, invasive species can also have a surprisingly "creative" side.

The researchers discovered that an invasive population of the freshwater snail Melanoides tuberculata, found on the island of Martinique, harbors a tremendous amount of genetic variation for key life-history traits, such as fecundity, juvenile size, and age at first reproduction. And that means they have a remarkably large potential for evolutionary change.

"It is widely believed that despite their tremendous ecological success, invasive populations, being founded by few individuals, lack genetic variability for important traits," said Benoît Facon of INRA – SPE in France. "Now, analyzing a freshwater snail example, we document how a spectacular genetic diversity for key ecological traits can be accumulated in invasive populations."

They provide further evidence that the snails' genetic diversity stems from multiple invasions of individuals hailing from different parts of their native Asia. That diversity has since been amplified as genetically distinct immigrants mated with one another to produce new generations of offspring with novel trait combinations. In fact, they said that the level of genetic variation seen in the snails is among the highest ever recorded among animals for fundamental life-history traits.

“Thus bioinvasions, destructive as they may be, are not synonyms of genetic uniformity and can be hotspots of evolutionary creativity,” Facon said.

M. tuberculata offered an “unparalleled opportunity” to study the adaptive potential of invasives because of its mixed reproductive system, meaning that the snails can reproduce both sexually and, more often, asexually. Therefore, many individuals in a population are clones of one another, each clone representing a “morph” with a distinctive shell. In Martinique, the researchers found seven such morphs: five of introduced origin, plus two produced by sexual crosses on the island.

The situation “provides the opportunity to observe the build-up of genetic variance in slow motion,” the researchers said, “since introduced genotypes remain intact even when they coexist with recombined genotypes produced by sexual reproduction.”

Although the mostly asexual breeding system of M. tuberculata is not a universal characteristic of invasive species, the researchers said they see no reason why multiple introductions could not generate similar trait diversity in purely sexual invasive species.

“The perception of biological invasions by scientists and the general public has up to now focused mostly on their destructive impact, ranging from economic loss to the threat of homogenization of earth biota and uniform domination by a few winning genotypes or species,” they added. “Our study adds to the growing body of evidence that invasions may also be creative and bring together original assemblages of genotypes or species, making them hotspots of evolutionary and ecological novelty. In order to predict the consequences of increased international trade and long-distance introductions, future studies will have to consider the two faces of biological invasions.”

Source: Cell Press