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Instituto Smithsonian de Investigaciones Tropicales

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**The Party Doesn't Start Until the Hosts Arrive;
Parasite Invasions Depend on Host Invasions**

Disease-causing organisms can be present in some areas where their hosts are not. If their hosts arrive, it can result in novel disease outbreaks. In the first comprehensive genetic analysis of an invasive marine host and its parasites, researchers trace invasion pathways of snails and trematodes from Japan to North America.

Their results, published in the Proceedings of the National Academy of Sciences, have broad implications for identifying and mitigating spreading disease in a global economy.

Simultaneously understanding the invasion pathways of disease-causing organisms and their hosts will be key in limiting future disease outbreaks—in humans, agriculture and wildlife.

Invasive populations of Asian mud snails, *Batillaria attramentaria*, probably arrived in North America with Pacific oysters, *Crassostrea gigas*, imported from northern Japan in the early 1900s. Genetic research by Osamu Miura, Tohoku University, and colleagues from the Smithsonian Institution and the University of California, Santa Barbara, confirmed this. “We saw a lot of genetic variation among snail populations in Japan, but the North American snails are genetically most similar to those from northern Japan, the source of the imported oysters,” Miura reports.

Of the eight species of trematode parasites that plague the snails in Japan, only the most common, *Cercaria batillariae*, has arrived in America. Luckily for the researchers, gene sequencing showed that this single species actually consisted of several genetically distinct cryptic species in its home range in Japan. In North America, they commonly found two of the cryptic species. One parasite shows much less genetic diversity in America than in Japan, whereas the other parasite is equally diverse in both regions.

“Genetic evidence suggests that while one cryptic parasite species experienced a bottleneck and probably came with the snails, the other was probably historically dispersed by migratory birds and could only establish in North America after the snail hosts arrived,” adds Mark Torchin, of the Smithsonian Tropical Research Institute. “This is because these trematode parasites have complex life cycles, using



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snails as first intermediate hosts, fishes as second intermediate hosts and birds as final hosts. As we homogenize biotas as a result of repeated species invasions through global trade, we increase the chances of reuniting infectious agents with suitable hosts.” Parasites which may have historically gone unnoticed as tourists in some regions may become pervasive residents after invasion of their missing hosts.

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The Smithsonian Tropical Research Institute, a unit of the Smithsonian Institution, headquartered in Panama City, Panama, furthers our understanding of tropical nature and its importance to human welfare, trains students to conduct research in the tropics and promotes conservation by increasing public awareness of the beauty and importance of tropical ecosystems. For more information, see www.stri.org.

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Reference: Introduced cryptic species of parasites exhibit different invasion pathways, 2006. Osamu Miura, Mark E. Torchin, Armand M. Kuris, Ryan F. Hechinger and Satoshi Chiba. Proceedings of the National Academy of Sciences.

Photos:

Miura at Elkhorn.jpg: Miura collecting invasive Asian mud snails, *Batillaria attramentaria*, in their introduced range, Elkhorn Slough, California. *Batillaria* and trematode.jpg: The invasive Asian mud snail,

Batillaria attramentaria, surrounding another exotic species, the reef-building tube worm, *Ficopomatus enigmaticus*, at Elkhorn Slough, California. Inset: Cryptic trematode parasite species introduced from Japan now infects *B. attramentaria* in North America. Credit: Mark E. Torchin, inset: Todd C. Huspeni.

Batillaria at Elkhorn.jpg: High densities of the invasive Asian mud snail, *Batillaria attramentaria*, carpet a mudflat at Elkhorn Slough, California. Credit: Mark E. Torchin.

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