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Selectively bred shrimp survive varied TSV exposure

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14-day study conducted at the University of Arizona

In 1999, significant mortalities of a Taura Syndrome Virus (TSV)-tolerant strain of the Western blue shrimp (*Litopenaeus stylirostris)* occurred at shrimp farms in Mexico. These mortalities resulted from TSV epizootics accompanied by a slight deviation in the gross signs typical of TSV infection, and there were concerns a new TSV strain had emerged.

Since 2000, researchers from the University of Arizona (UAZ) in Tucson, Arizona, USA, have analyzed TSV geographic and year isolates in relation to a reference isolate from Hawaii, USA, to determine possible differences in virulence and host range. Using selected Office International des Epizooties (OIE) diagnostic methods and sequence analysis of nucleotides and amino acids in the viral genome, the researchers compared the reference isolate with three TSV isolates from Mexico and found similar but distinct isolates of TSV.

Selectively bred shrimp were maintained in 1,000-liter fiberglass tanks containing artificial seawater.

New serotype from Belize

In 2001, significant mortalities of *L. vannamei* from TSV epizootics at shrimp farms in Belize raised concerns that another TSV strain had emerged. UAZ researchers purified the Belize 2002 isolate of TSV from cultured *L. vannamei* and found the virions were slightly but significantly larger than those from Hawaii and Mexico.

Again, using OIE diagnostic methods and sequence analysis, UAZ researchers concluded that the Belize isolate represented a new serotype. Importantly, broodstock suppliers to Belize reported that shrimp bred for resistance to the "old" Taura strain, the Hawaii isolate, succumbed to the "new" Belize strain.

Research to develop tolerance

In response to these concerns, researchers from the Oceanic Institute explored the possibility of developing selectively bred families of *L. vannamei* that exhibited tolerance to both the Hawaii and Belize TSV serotypes. Since 1995, researchers at Oceanic Institute have developed families of shrimp that exhibit high survival to the Hawaii TSV serotype.

Offspring from these unique families were produced and distributed to several U.S. broodstock suppliers and subsequently challenged with both TSV serotypes. Results from these challenge tests are summarized below.

Experimental challenge

Juvenile shrimp of about 2 grams from Rainbow Hawaii Farms of Mililani, Hawaii, USA, were shipped to UAZ and exposed to the TSV serotypes by feeding them infected shrimp tissue at 10 percent of their body weight once per day for three consecutive days. Shrimp survival was monitored daily, and final survival was determined after 14 days (Table 1).

Moss, Survival of two populations of *L. vannamei*, Table 1

TSV Serotype	Shrimp Strain	Survival (%)
Hawaii TSV	O.I. "Kona" shrimp (Positive control)	20
Hawaii TSV	Rainbow Hawaii Farms shrimp	95
Belize TSV	O.I. "Kona" shrimp (Positive control)	0
Belize TSV	Rainbow Hawaii Farms shrimp	63
None	Rainbow Hawaii Farms shrimp (Negative control)	100

Table 1. Survival of two populations of *L. vannamei* after 14 days when exposed to two TSV serotypes.

Positive and negative control groups were also evaluated. The negative control group, which consisted of selectively bred shrimp fed a commercial diet for the 14-day study, evaluated shrimp mortalities unrelated to TSV exposure. Positive control groups consisted of the Oceanic Institute "Kona" reference strain of *L. vannamei* exposed to both TSV serotypes. Kona shrimp are susceptible to TSV and exhibit consistently low survival of 0 to 40 percent after TSV exposure.

Positive controls were evaluated to ensure the virus-infected tissue used in the challenges was infectious. All selectively bred shrimp were maintained in 1,000-liter fiberglass tanks, whereas the Kona shrimp were maintained in 90-liter glass aquariums. The tanks and aquariums contained artificial seawater at 33 ppt salinity and 29 degrees-C and were equipped with biological filters.

Survival to TSV exposure

The selectively bred shrimp exhibited 95 percent survival after exposure to the Hawaii TSV serotype, while the Kona reference strain experienced only 20 percent survival. The selectively bred shrimp also had 63 percent survival after exposure to the Belize TSV serotype, whereas all the Kona shrimp died by day 4 of the challenge test.

These results indicated the Belize TSV serotype was more lethal than the Hawaii serotype, especially for the reference shrimp. However, through artificial selection or other genetic improvement techniques, shrimp breeders may be able to compete in the "arms race" against mutating viral pathogens.

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