Scientists find explanation for global advance of shrimp virus

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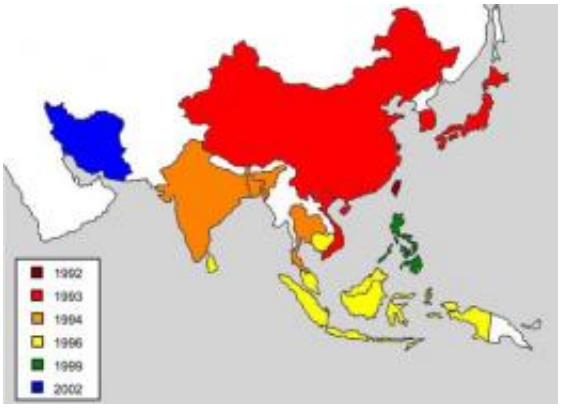

Figure: Spread of the WSSV virus in Southern Asia. The virus spread over the entire region from its source in Taiwan within several years.

White spot syndrome virus (WSSV) has a devastating impact on shrimp farming throughout the world. What makes the situation even more serious is that the virus seems to become more aggressive as the epidemic spreads, contrary to other viruses, such as flu virus, that gradually die out.

Scientists from Wageningen University, the Netherlands, reconstructed the genetic and geographical trajectory of the shrimp virus from the putative ancestral source, and discovered that the fitness of the virus increases over time and the genome shrinks, in a pattern similar to theoretical predictions from evolutionary biology. These remarkable

findings have just been published in the online edition of the journal PLoS One.

Global shrimp production tripled over the past decade from 750,000 tonnes in the 1990s to more than three billion tonnes over the past five years, severely affecting coastal ecosystems and livelihoods. WSSV is a deadly pathogen for shrimp, and a major threat to shrimp farming for the last two decades. Over time the virus manifested itself more severely. Documented outbreaks in 1992 (China) and 1999 (Ecuador) showed a 70% reduction in local shrimp production in the years after the outbreak. The virus has since spread globally and has even been found in wild crustaceans in Europe.

Wageningen University scientists analyzed samples of the virus in shrimps from five Asian countries, then compared them to each other and published literature on WSSV from Taiwan, China, Vietnam and Thailand. This allowed the authors to clarify which genetic and fitness changes have occurred in the various virus populations since the virus was first discovered.

Deletions

The large genome of the WSSV virus has regions that vary among isolates, which mainly distinguish themselves by missing DNA fragments, or so-called deletions. By lining up a time series of virus samples, the scientists found a remarkable pattern: that the majority of these variable regions disappeared from the genome initially, but that the deletion rate decreased over time in a process that could be mathematically described. Tests with shrimp showed that the virulence of the virus increased accordingly.

Both changes appear to be evolutionary adaptations of the virus to the shrimp farming practices. Additionally the virus seems to have spread

over long distances in a short timeframe, which points to transportation of infected shrimps as the major factor. Preventing the virus from spreading is a major area of improvement in combating future virus outbreaks in shrimp production systems. Understanding the epidemiology of WSSV at different temporal and spatial scales should lead to further control and containment of the disease.

Provided by Wageningen University