

Examining Genetic Differences in Farm Raised Pacific White Shrimp

A.S. Leaflet R1971

K. L. Glenn, Research Associate II
 T. Suwanasopee, Graduate Student at Kasetsart University,
 D. L. Harris, Professor
 T. Sornthep, Professor at Kasetsart University, and
 M. F. Rothschild, Distinguished Professor

Summary and Implications

Genomic DNA was extracted from ten shrimp of the Pacific white shrimp or *Litopenaeus vannamei* species and used to find single nucleotide polymorphisms (SNPs) in the *Alpha-amylase* (*-AMY*) and the *Cathepsin-L* (*CTSL*) genes. This study lays the groundwork for future research to examine the association of genetic markers and the growth rate of farm raised pacific white shrimp.

Introduction

Pacific white shrimp, *Litopenaeus vannamei*, is a non-indigenous shrimp species that has become the leading farm-raised species in the Western Hemisphere, representing more than 95% of commercial production. The study objective was to find genetic markers called single nucleotide polymorphisms (SNPs) in both the *Alpha-amylase* (*-AMY*) and the *Cathepsin-L* (*CTSL*) genes. These SNPs are small genetic changes or variations that occur when a single nucleotide (A, T, C, or G) in the genetic sequence is altered. For example, the nucleotide letter A replaces one of the 3 other nucleotide letters: C, G, or T. These two particular genes were chosen because of their possible involvement with growth in the shrimp. Alpha-amylase is an enzyme that breaks down complex sugars and is associated with the digestive gland in crustaceans.

Cathepsin L is a protein-degrading enzyme that is involved in the molting cycle of shrimp.

Materials and Methods

Ten shrimp were acquired from a breeding tank and tissue was obtained for DNA extraction. Regions of Alpha-amylase and Cathepsin-L were sequenced in the ten shrimp. Once sequence differences were found, then genetic tests were designed to classify the shrimp into their different genotypes. A genotype refers to the pair of genetic differences in a certain position of the gene sequence.

Results and Discussion

The gene names, genotypes and genotype frequencies are summarized in Table 1. Further research should examine the association between these SNPs and the growth rate of *Litopenaeus vannamei*.

Acknowledgements

This work was supported in part by the Thailand Research Fund, Sygen International, Iowa Agriculture and Home Economics Experiment Station, Ames, Iowa and by Hatch Act and State of Iowa funds. We would like to thank Dr. Kwan-Suk Kim, Marcos Ramos, Laura Grapes, Renata Hernandez and Dr. Charles Otieno for their assistance.

Conclusions

These results suggest that Pacific White Shrimp are extremely genetically variable. This variability will aid shrimp breeders in making genetic improvement in the future.

Table 1 Gene names, sequence differences and genotype frequencies.

Gene	Sequence differences	#of shrimp genotyped	Genotype frequencies		
			11	12	22
<i>Alpha-amylase</i>	1	10	0.2	0.7	0.1
	2	10	0.2	0.8	0
	3	10	0.2	0.8	0
	4	9	0.89	0.11	0
<i>Cathepsin-L</i>	1	7	0.71	0.145	0.145
	2	10	0.4	0.5	0.1