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Tail weight, yield traits considered for shrimp-breeding program

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When selecting for the two traits, responses for body weight and yield were similar

The authors' study evaluated the potential advantage of incorporating yield values in breeding programs at Mexico's largest shrimp hatchery.

Shrimp market prices are based on body weight, although one of the main commercialization forms is based on shrimp tail weight, such that the tail is the main component of the processed shrimp. Hence, it is important to evaluate the feasibility of incorporating the tail weight and yield (proportion of the total body weight represented by the tail weight) in breeding programs with the aim of increasing farmers' profitability.

Selection criteria

Breeding programs for Pacific white shrimp (*Litopenaeus vannamei*) have been focused on improving growth traits, survival and resistance to specific diseases. That is why selection criteria are usually defined to obtain a high commercial value biomass – producing a large number of shrimp with high individual body weights. Tail weight, yield and their association with body weight are usually not considered.

When considering a selection criterion for a breeding program, it is important to first answer these questions: Can the criterion be measured in the selection candidate or its relatives? Is it heritable and related to the breeding objective? Does the trait show genetic variation? Is it profitable to measure it?

With the aim of answering these questions in relation to the possible inclusion of yield tail weight in the breeding program of Maricultura del Pacifico, the largest penaeid shrimp hatchery in Mexico, the authors carried out a study designed to estimate heritabilities for body weight, tail weight and yield at 130 days of age, as well as their genetic correlations.

Study setup

To estimate genetic parameters, 8,208 body weight, tail weight and yield records from 2010 for 150 families were otained from the Maricultura del Pacífico hatchery breeding program. The analysis considered a nine-generation pedigree file for 2002 to 2010. Additionally, the body weight and yield relative economic values were obtained from a profit equation using Mexican shrimp market prices.

To evaluate the potential advantage of incorporating yield in the economic response for this population, the economic response was compared with a selection index based on these economic values that involved body weight and yield, with another that involved body weight only.

Results

The means and standard deviations were 15.4 ± 2.6 grams for body weight, 9.6 ± 1.6 grams for tail weight and 61.9 ± 1.8 percent for yield. The genetic correlation between body weight and tail weight was essentially 1, which implied that in practical terms, they are the same trait. Hence, the decision about which trait to include in the breeding program depends on the cost of measuring the traits. In this case, obtaining the tail weight implies added labor, increased costs and, in some breeding schemes, the loss of evaluated animals as potential breeding candidates.

Yield has a smaller genetic variation than body weight. Moreover, the genetic correlations between yield and body weight (0.30), and between yield and tail weight (0.48) were not statistically significant.

When comparing the economic response per generation for family selection using an index that consideredbody weight and yield with relative weights of 35 grams and 8.5 Mexican pesos, respectively, with that obtained with an index that considered only the body weight, the response for the index with both traits was 17.2 Mexican pesos, compared to 17.0 Mexican pesos for an index that considered only body weight. When selecting for the two traits, the responses for body weight and yield were similar in both cases: 0.49 grams and 0.01 percent, respectively.

Perspectives

The authors concluded that it is not necessary to include tail weight as an additional trait or to replace body weight with it in Pacific white shrimp-breeding programs because measuring either of the two traits led to a similar result.

Although including yield in addition to body weight in selection indices appears to increase the economic response to selection, the expected economic response if yield is ignored is 99 percent of that obtained using both traits. This is due mainly to the smaller genetic variation of yield, but also to its lower economic value when compared to that of body weight.

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