REPRODUCTION OF THE HAWAIIAN STRAIN OF PACIFIC BLUE SHRIMP *LITOPENAEUS STYLIROSTRIS* IN NEW CALEDONIA.

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Abstract

The Pacific blue shrimp *Litopenaeus stylirostris* was introduced in New Caledonia thirty years ago. Because of its high inbreeding, a SPF strain domesticated in Hawaii, genetically differentiated from the Caledonian strain, had to be imported. The two strains' reproductive performances were compared at different periods and cross breedings were assessed. The average results show that Caledonian animals give twice as many nauplii than the Hawaiian animals. The best cross breeding is obtained with Caledonian male x Hawaiian female. A possible explanation is the later age or weight of maturity for the Hawaiian strain compared to the Caledonian strain, difference which could come from the geographical origins and/or the zootechnical and climatic domestication conditions.

Introduction

Shrimp industry in New Caledonia is entirely dependent on a captive broodstock of *Litopenaeus stylirostris.* All the 40 generations of the Pacific blue shrimp in New Caledonia to date come from a thousand juveniles imported in the late 70's. During this period, the number of breeders participating to the production of the next generation was often low. Indeed, no care was taken to the management of the genetic variability and the study of the allelic diversity has shown that the Caledonian strain has only 10 % of the allelic variability of a wild population in Ecuador. In the mean time, two seasonal pathologies have affected the profitability of the farms in New Caledonia; the high inbreeding of the shrimps is supposed to be one of the causes of the weakness of the animals. In order to increase the allelic diversity and develop a genetic improvement program, but minimizing the risk of importing unknown pathologies, it was decided to introduce a *L. stylirostris* strain from Hawaii, domesticated for 8 generations under quarantine conditions. This strain originating from Ecuador and domesticated in Hawaii, is genetically differentiated from the Caledonian strain of mexican origin.

Material and methods

In March 2005, the eighth generation of *L. stylirostris* juveniles (G8) was sent from Hawaii to New Caledonia. After 5 months in quarantine and 5 months in extensive conditions at Ifremer's laboratory, one year old breeders were harvested and a new generation of Hawaiian shrimp (G9) was produced. This generation was reared in earthen pond and reproduction was tested at three different periods in 2006 in comparison with Caledonian strain.
Different combinations of reproduction with the two strains were assessed:
- Caledonian female with Caledonian male (CCxCC) in november 2005, august 2006, november 2006 and january 2007 ;
- Hawaiian female with Hawaiian male (HHxHH) in G8 (november 2005) and G9 (august 2006, november 2006 and january 2007) ;
- Hawaiian female G9 x Caledonian male (HHxCC) in august 2006, november 2006 and january 2007 ;
- Caledonian female x Hawaiian male G9 (CCxHH) in august 2006, november 2006 and january 2007.

For every production, one hundred to two hundred females of each strain were stocked in maturation room. Females were eyestalk ablated and artificial insemination was practiced.

Each time, mean weights of the breeders were taken and the percentage of eggs giving nauplii (% eggs in nauplii) was calculated from the fertilization and hatching rates .
This parameter is compared between the two *L. stylirostris* strains, but also for the Hawaiian strain at the two successive generations (G8 and G9 at one year old), at different ages (9 months old, 12 months old and 14 months old) and the hybrids.

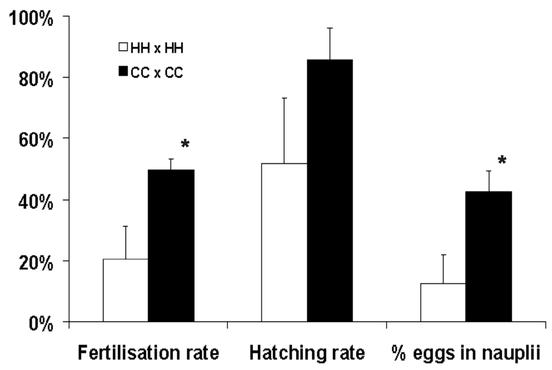

Figure 1 : Percentages of fertilization, hatching and eggs in nauplii for Hawaiian and Caledonian strains. (* significant difference at p < 0.05)

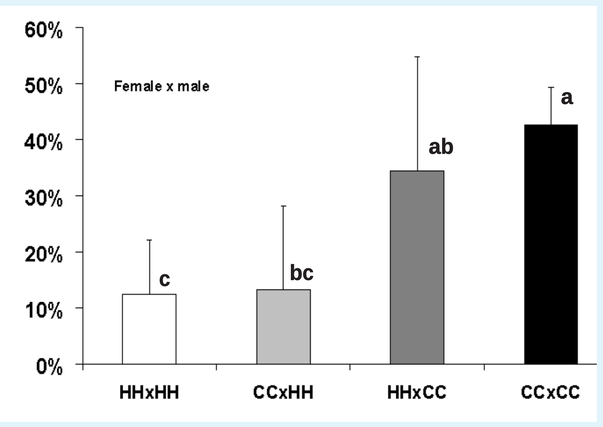

Figure 2 : Percentage of eggs in nauplii depending on the crossing. (treatment means with a different letter are significantly different (p < 0.05) using an ANOVA)

Results - Discussion

The average results show that fertilization and hatching rates are higher for the Caledonian strain (figure 1).
Consequently, the average percentage of eggs in nauplii is three times higher for the Caledonian strain compared to the Hawaiian one. The mean number of nauplii per spawn for the four productions are 30 000 and 68 000 for the Hawaiian strain and Caledonian strain, respectively. These differences are mainly due to the very low fertilization rate for the Hawaiian strain. When the Hawaiian strain is crossed with the Caledonian one, results are intermediate. The best cross breeding is obtained when Hawaiian females are inseminated artificially with Caledonian males (HHxCC - figure 2). It thus seems that male fertility is the current main problem of the Hawaiian strain.

Growth of the Hawaiian breeders was faster than the Caledonian one but can partially be linked to the lower stocking density in the Hawaiian broodstock pond (figure 3).

From one year to the next, reproductive performances of the Caledonian strain are quite stable while the number of nauplii has decreased in 2006 compared to 2005 for the Hawaiian strain (figure 4). Reproductive performances of the Hawaiian strain improved with age but did not quite reach the level of the Caledonian strain.

The Caledonian strain is well adapted to the local climatic conditions, particularly the fresh season and the low water temperatures (around 20°C) from July to September. These may affect in some way or another the reproductive response of the Hawaiian strain.

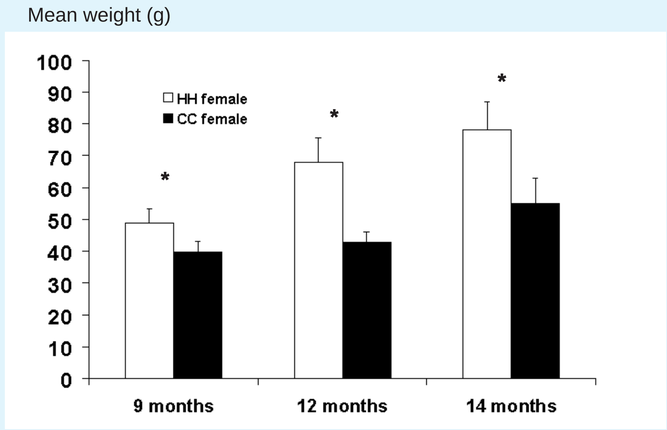

Figure 3 : Female mean weight for Hawaiian and Caledonian strains depending on age. (* significant difference at p < 0.05)

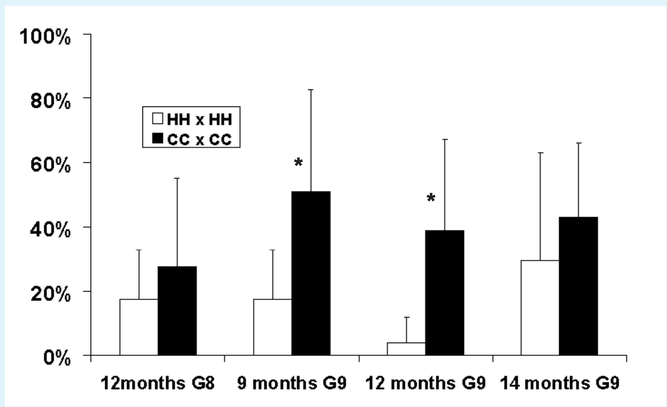

Figure 4 : Percentage of eggs in nauplii for Hawaiian and Caledonian strains depending on age. (* significant difference at p < 0.05)

Conclusion

A possible explanation is the later age or weight of maturity for the Hawaiian strain compared to the Caledonian strain, difference which could come from the geographical origins and/or the zootechnical and climatic domestication conditions. This hypothesis will be assessed in the next reproduction cycle in 2007-2008.

Acknowledgments

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