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Health & Welfare

Temperature affects sperm quality in L. vannamei

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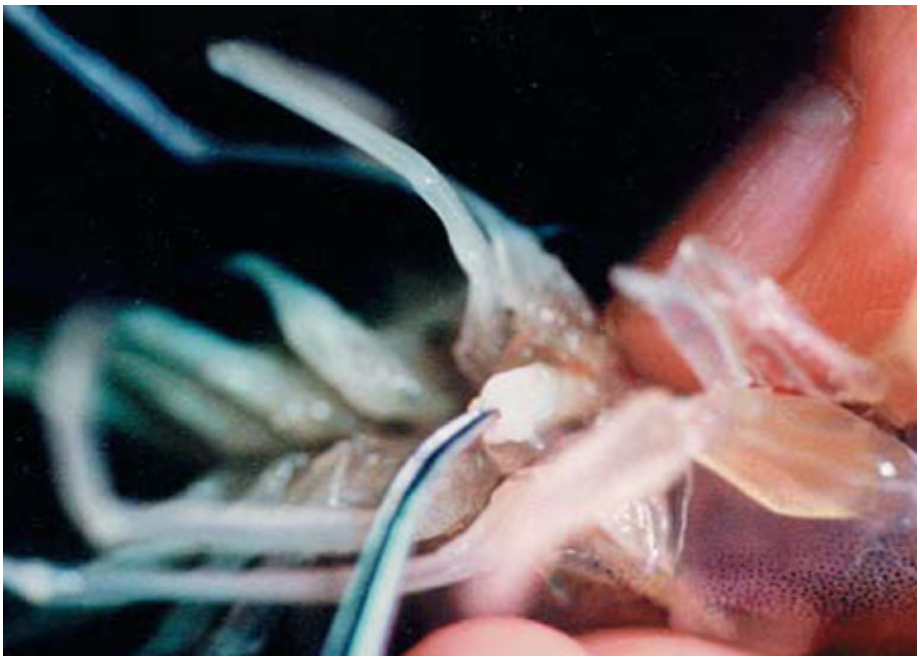
Texas A&M findings could lead to improved breeding conditions

It is well known that in man, as well as other mammals, the temperature of the scrotal sac is normally maintained a few degrees below mean body temperature. This phenomenon maintains the integrity of sperm, for sustained elevated temperature in testes reduces sperm count and increases the percentage of abnormal sperm.

Interestingly, a study recently conducted at the Texas Agricultural Experiment Station, Shrimp Mariculture Project of the Texas A&M University System in Port Aransas, Texas, USA showed that temperature also affects the sperm quality of Pacific white shrimp (*Litopenaeus vannamei)*, the most commercially important shrimp species in the Americas.



High temperatures can damage sperm in shrimp and cause sterility.

Experimental setup

Groups of male broodstock with a mean weight of 47.9 grams were exposed to water temperatures of 26, 29 and 32 degrees-C for 42 days. The experiment was conducted under controlled laboratory conditions, meeting high standards for water quality.

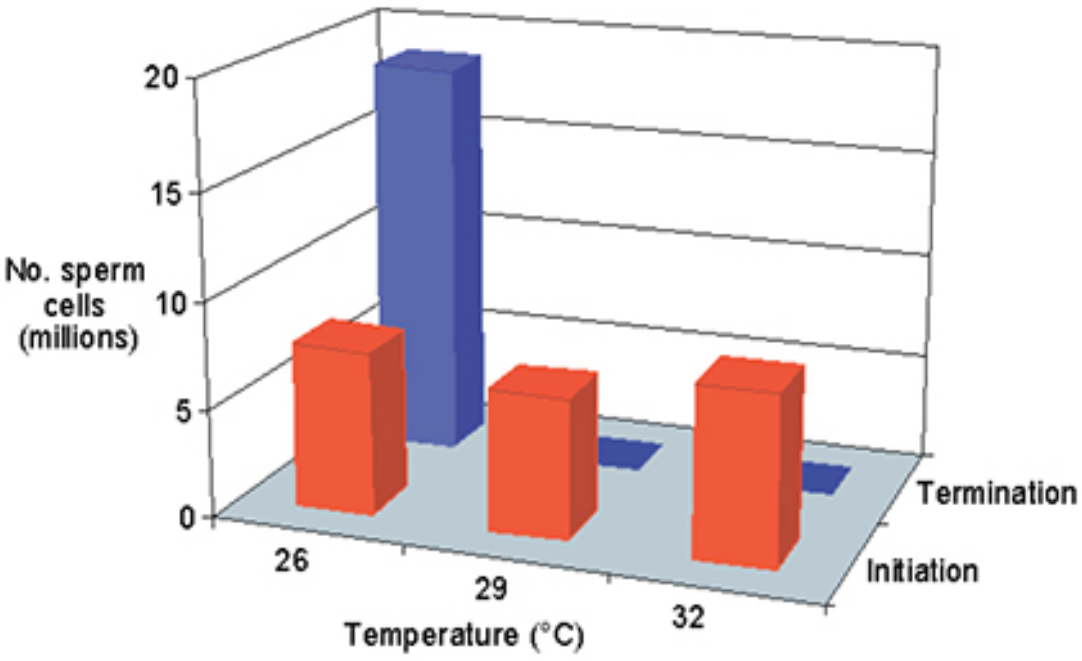


Fig. 1: Sperm counts of *L. vannamei* maintained at three different water temperatures.

The sperm quality of the shrimp, as determined by sperm count and percentage of abnormal sperm, was evaluated at initiation and termination of the experiment.

Results

Animals held at 26 degrees-C showed a more than twofold increase in sperm counts with respect to the initial value, while the sperm quality of shrimp kept at the higher temperatures was deeply affected, rendering the animals sterile. Sperm collected from these organisms consisted mainly of pieces of disrupted sperm cells, resulting in dramatically decreased sperm counts (Fig. 1).

As a result of the extensive deterioration of sperm, the percentages of abnormal sperm increased to very high values for these organisms. In fact, all or almost all sperm were abnormal. In contrast, the percentage of abnormal sperm from shrimp maintained at 26 degrees-C remained almost constant (Fig. 2).

Conclusion

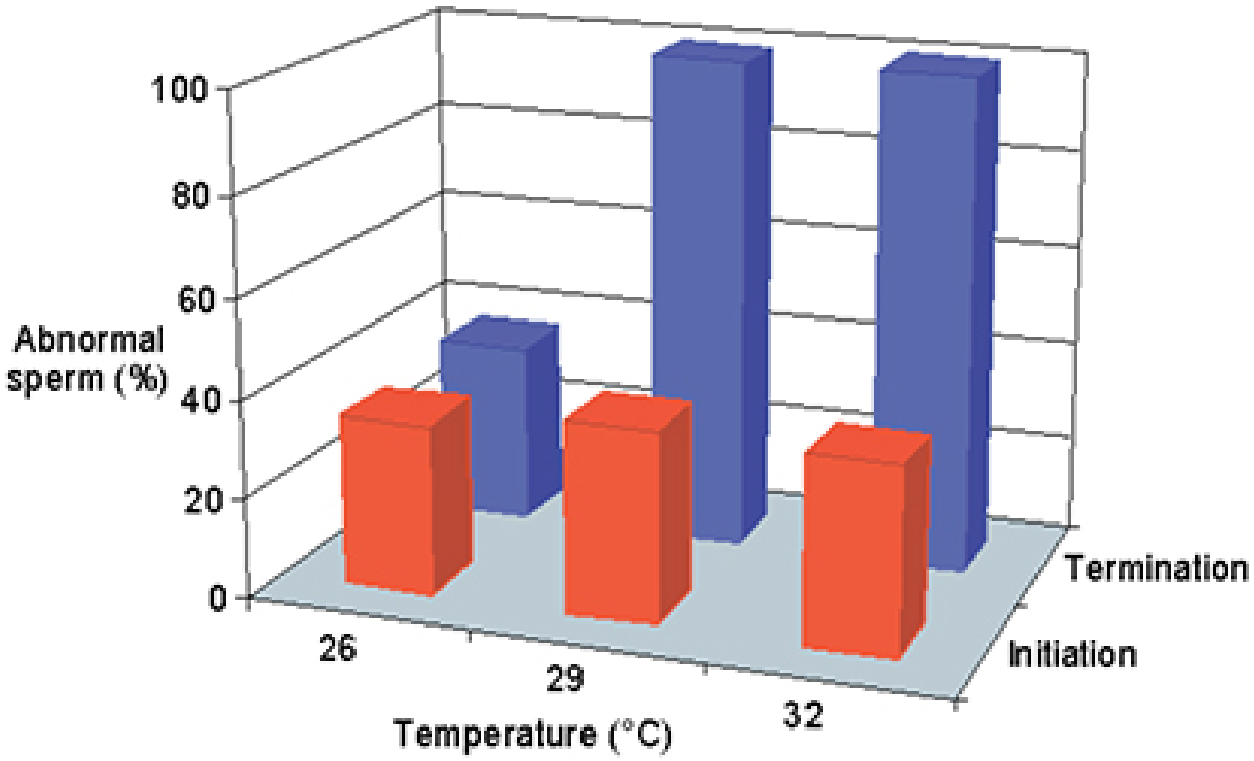


Fig. 2: Percentage of abnormal sperm of *L. vannamei* maintained at three different water temperatures. Data used with permission from Elsevier, published in Aquaculture, Vol. 198 – Perez-Velazquez, M.,; Bray, W. A.; Lawrence, A. L.; Gatlin III, D. M.; González-Félix, M. L. Effect of temperature on sperm quality of captive *Litopenaeus vannamei* broodstock.

The marked sensitivity to deterioration of sperm quality at high water temperature by *L. vannamei* shown in this study can contribute to an improvement of breeding conditions for this species. Also, the results have direct relevance for rearing sub-adult male shrimp for reproduction purposes, especially for maintenance of male-only populations.

The temperature-sensitive nature of sperm has been reported for other shrimp species like *L. setiferus* and *L. stylirostris*, as well as a number of mammals. Perhaps the specific mechanisms for heat-induced deterioration of male fertility in these varied animals are similar. This is an area that deserves further research.

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