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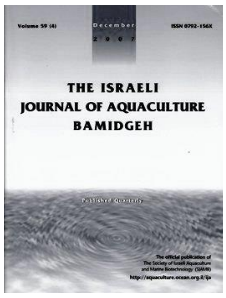

An Arithmetic Index Based on Shell Height, Length, and Width, for Potential Selection of Soft-Body Wet Weight in Pacific Oyster, *Crassostrea gigas*

Xiaotong Wang[1,*], Ting Liu[2], Yongshan Liu[1], Peiyong Feng[1]

[1] *School of Agriculture, Ludong University, Yantai 264025, China*

[2] *College of Life Science and Engineering, Shaanxi University of Science & Technology, Xi'an 710021, China*

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Key words: Pacific oyster, selective breeding, soft-body wet weight, arithmetic product of shell length, height and width

Abstract

The Pacific oyster, one of the most widely grown bivalves, has a long commercial history, a large consumer base, and is one of the most important commercially cultured mollusks in the world. Only the soft body is edible therefore increasing the soft-body wet weight (SBWW) is the main breeding objective for oysters. The SBWW cannot be measured in-vivo. In general, the shell height (H) or shell length (L) are used to indirectly choose SBWW. But they are diverse and susceptible to environmental influences so they are not indicative of higher SBWW and inappropriate for the selection of optimal brooders. In this study, H, L as well as shell width (W) of wild and cultured populations were measured and the correlation coefficients between H, L, W, HLW (the arithmetic index based on shell height, length and width) and SBWW were calculated and found to be potential indicators for selective breeding of SBWW in Pacific oyster.

* Corresponding author. e-mail: wangxiaotong999@163.com

Introduction

Oysters have been cultured for well over a century. The Pacific oyster, *Crassostrea gigas*, is presently one of the most widely grown bivalves and one of the most important commercial mollusks around the world (FAO). Though some methods related to molecular breeding of oysters have been studied (Wang et al., 2011; Wang et al., 2012), conventional breeding including phenotypic selection are still the most efficient methods.

Increasing the SBWW is the main breeding objective of oyster culture, but it cannot be measured in-vivo. Generally, H or L are used to indirectly select SBWW. But there are huge differences in different environments (Mahon, 1983), and these indices are not appropriate for SBWW selection, therefore more accurate indices are required for this purpose.

Materials and Methods

Subjects. Two wild populations of pacific oysters from Penglai and Rushan and nine others cultured in Yantai (C1, C2, C3, C4, C5, C6, C7, C8, C9) in Shandong Province, China were used for this study.

Experimental methods. All oysters (11 groups, 30-78 each group) were brushed clean. Wild populations and cultured populations were temporarily held in plastic tanks for 3 days and fed with Spirulina powder.

The SBWW of each oyster was measured with an electronic scale. After weighing, each oyster was measured with Vernier calipers to determine shell height (maximum dorsal-ventral dimension), shell length (maximum anterior-posterior dimension), and shell width (maximum lateral dimension).

Data analysis. HLW was calculated using the following equation: HLW=H*L*W. The correlation coefficients between H, L, W, HLW, with SBWW were calculated and the significance of these correlation coefficients was also tested at the same time with CORR function in SAS (Statistics Analysis System) 9.0 software, respectively.

Results

The H, L, W and SBWW data was presented in supplementary materials (Table S1-11). As shown in Table 1 and Figure 1, in all populations, there are highly significant positive correlations between H, L, W, HLW, and SBWW (p<0.01), but the correlation coefficients are different. The correlation coefficient between HLW and SBWW is the greatest (Red background) in each group.

In addition, the correlation coefficients between HLW and SBWW in cultured populations are greater than in wild populations (Figure 1 and Table 1).

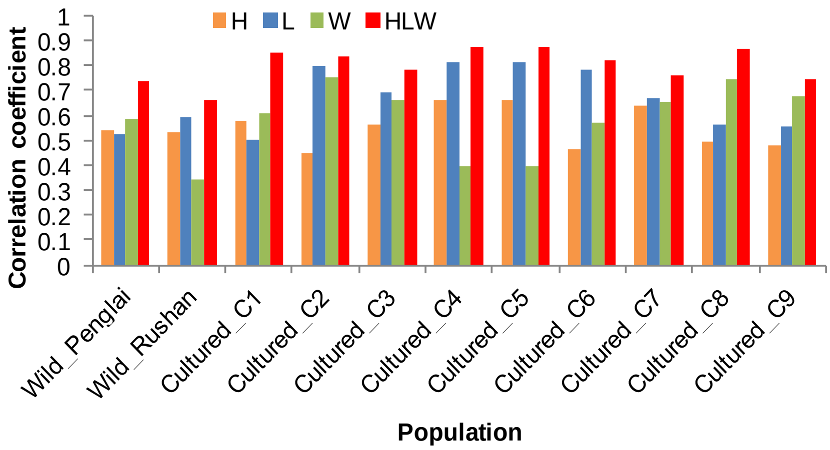

Fig. 1. Comparison of the correlation coefficients between H, or L, or W, or HLW, and SBWW in different populations.

Table 1. The correlation coefficients and their significance level between H, or L, or W, or HLW, and SBWW.

	Number of subjects	H-SBWW	L-SBWW	W-SBWW	HLW-SBWW
Wild-Penglai	53	0.54073	0.52786	0.58558	0.73393
***P*-value**		<.0001	<.0001	<.0001	<.0001
Wild-Rushan	41	0.53522	0.59047	0.34247	0.6625
***P*-value**		0.0003	<.0001	0.0284	<.0001
Cultured_C1	32	0.57646	0.50184	0.60861	0.85457
***P*-value**		0.0006	0.0034	0.0002	<.0001
Cultured_C2	32	0.44572	0.80139	0.74882	0.83462
***P*-value**		0.0106	<.0001	<.0001	<.0001
Cultured_C3	30	0.56056	0.69381	0.66272	0.78059
***P*-value**		0.0013	<.0001	<.0001	<.0001
Cultured_C4	32	0.65992	0.8098	0.39319	0.87594
***P*-value**		<.0001	<.0001	0.026	<.0001
Cultured_C5	32	0.65992	0.8098	0.39319	0.87594
***P*-value**		<.0001	<.0001	0.026	<.0001
Cultured_C6	32	0.46364	0.77958	0.56687	0.82021
***P*-value**		0.0075	<.0001	0.0007	<.0001
Cultured_C7	78	0.63955	0.66688	0.65319	0.76061
***P*-value**		<.0001	<.0001	<.0001	<.0001
Cultured_C8	32	0.4917	0.56253	0.74192	0.86891
***P*-value**		0.0043	0.0008	<.0001	<.0001
Cultured_C9	72	0.47825	0.55643	0.68021	0.74523
***P*-value**		<.0001	<.0001	<.0001	<.0001

Discussion

Table 1 and Figure 1 show that the correlation coefficient between HLW and SBWW in each population is greatest, suggesting that HLW is more suitable as the indirect index for SBWW selection than H, L, or W. Using HLW to select SBWW may promote breeding efficiency and accelerate breeding of Pacific oyster.

The correlation coefficients between HLW and SBWW in cultured populations are greater than in the two wild populations, indicating that a wild, varied, and complicated environment is likely to cause greater diversity in oyster shape.

Though many new selection methods are emerging (e.g. molecular marker assistant selection, MAS), phenotypic selection is still the basic and primary breeding method (Kingsolver et al., 2012; Piepho, et al., 2008), especially for mollusks because it is difficult to apply MAS to them. The arithmetic index based on shell height, length, and width (HLW) may be potentially useful for Pacific oyster breeding.

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Supplementary materials (Table S1-11) can be downloaded at http://dl.vmall.com/c00c28aroa.