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Characterization of novel EST-SNP markers and their association analysis with growth-related traits in the Pacific oyster *Crassostrea gigas*

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01 / 01

Abstract *Crassostrea gigas* , 10 ( ) ( ) . 10 , 0.011 0. 0.0 1 0. 01. , (*P* 0.0001). , 0 , 0 0, 1 , (*P* 0.01). 0. %. 0 0 1 *C. gigas*. *C. gigas*.

Keywords *Crassostrea gigas* ·

Introduction

Crassostrea gigas, … 1 0 (… 00).

… (… 01) … *C. gigas* …

… *Ostreid herpesvirus 1* (… 01). … 00 … 00 … 010) … (… 011) …

… 00 … 00). … 00). …

… *Paralichthys olivaceus* (… 00) … *Salmo salar* (… 00), … (… 01). …

… 00). … 010), … (011), … (… 01), … (… 01), … (… 01), … (… 00 … 01 , 01 … 01 … 01). …

… *Crassostrea* (… 00 … 00).

… (… 00). …

… (… 00 … 00). … (… 00 … 00 … 01).

…

Materials and methods

Animals and DNA extraction

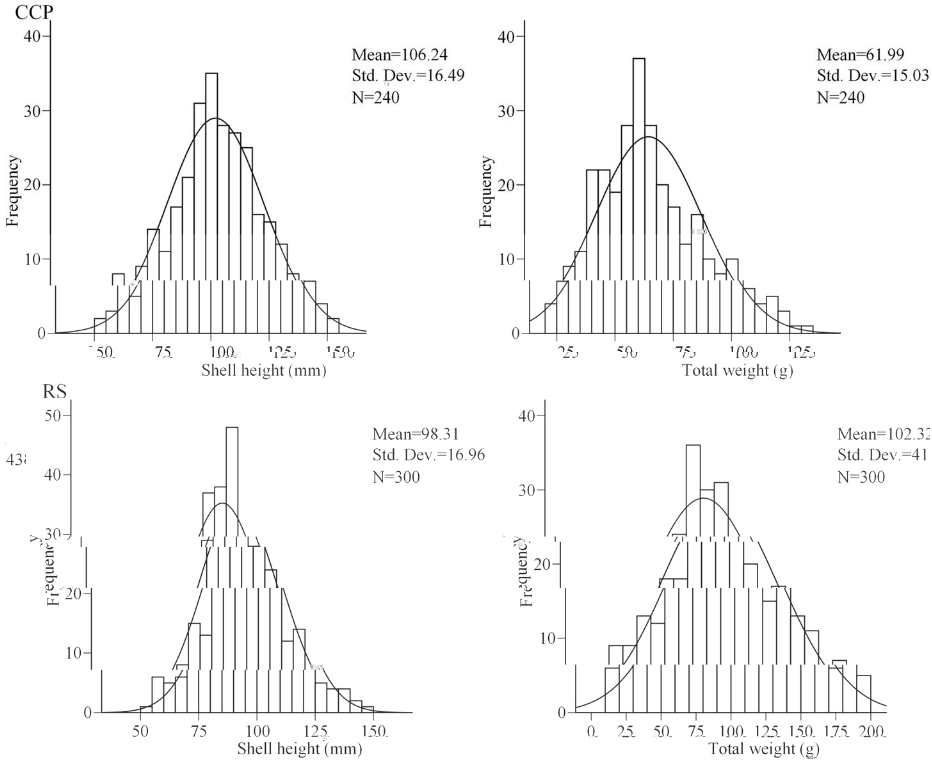

Fig. 1

EST-SNP mining and validation

Amplification and genotyping

(c c ,). 10-μ c
10 , 1. , 0. , 0. μ
, 10 , 0. *Taq* (, ,),
μ (, , ,). c c c c
0 c c 10 ,
0 10 , 10 . c
c c c c 0 0 c .
G c
c 0 1. (c c).

Genetic analysis and function prediction

c c , c , c c ( ),
(*H*) c (*H*) c c .0
(. 00). c c
E 1.0 10 (// . c . . . /).
( )
, , ( ).

Marker-QTL association analysis

c G . (00) c c
c Q c c c
c c χ (*P* 0.0001) - c c
(c 1)

$$\chi = (\hat{p}_1 - \hat{p}\ )\ /\ \ p$$

$\hat{p}_1$ c c G , $\hat{p}$
c , p c c c .
c p

$$p = \hat{p}\ (1 - \hat{p}\ )[1 - (1 - 1/N)(1 - 1/Ns)]$$

N c c G (*N* 1) *N*
c c *N* c
(*Ns*).

Validating the candidate SNPs associated with growth

c G
, c ,
, - (*P* 0.01).
c c c c
c c .

$$pq(\alpha + \delta(q - p)) \, /V_A$$

Results

SNP development and characterization

Description of phenotypic variability in the experiment populations

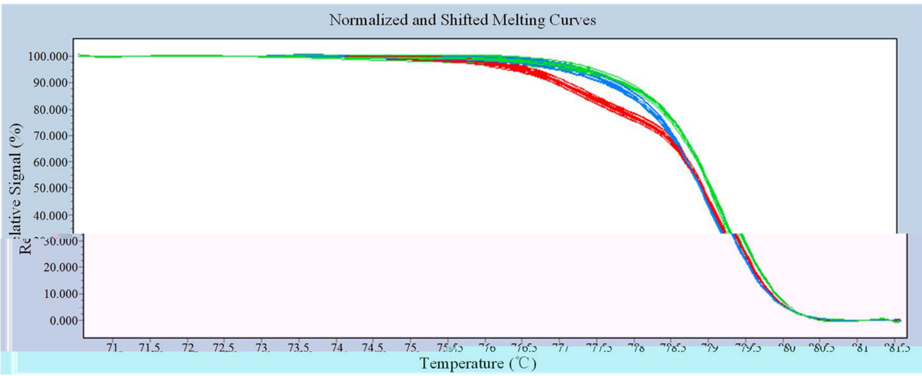

Fig. 2 … GG … *Green curves* … GG, *blue curves* … , *red curves* … G

(T 1). , , , 1 . 1.0 , . .1 , . 0. , 10 . 0 1. 0 , .0 1.11 , 1 .0 . , . 0. , .0 0. 1 , 1 1. . , .10 1. 1 , c , c (*P* 0.01) (T).

Identify and confirmation of SNPs associated with growth

c , c c (00 , 0 , 0 0, 1 , 1 , 1, , 1 , 1) c c G (*P* 0.0001) (T). c ( ) ( ). c c G . , c 0 , 0 0, 1 c c . T c c QT c *P* 0.01 (T

Table 3 [illegible]

[illegible]	$\hat{p}_1$	$\hat{p}$	p_1	χ
00 /[illegible]	0. 0	0.0 0	0.001	[illegible]*
0 /G	0.	0.0 1	0.001	[illegible]1 *
0 0/	0. 0	0.0	0.000	.11 *
1 /[illegible]	0.	0.	0.00 0	[illegible]*
[illegible] /G	0. 10	0.1	0.00	[illegible]*
1/G	0.	0.1	0.00	[illegible]*
/	0.	0.	0.00	.01 *
1 /	0. 1	0. 0	0.00	.0 1*
1 /	0.	0.1	0.00	.1 1 *

*P 0.0001, [illegible]

[illegible] G ( ) [illegible] 0 1 [illegible] 0 [illegible]

Discussion

[illegible] 0 [illegible] 10 (. %) [illegible] % [illegible] (01). [illegible] *C. gigas* [illegible] 0–11 [illegible] (. 00 [illegible] 01). [illegible] (. 00) [illegible]

Table 4 [illegible] ( ) [illegible]

[illegible]	[illegible]	(%)		χ	[illegible]	(%)		χ
0 G	0	0.	0.	. *	[illegible]	0.	0.	1 . *
0 0 [illegible]	1	0.	1. 1	11.0 *	1	.	0.	1 . *
1 [illegible]	1 1	1.	0.	1 . *	0	0.	1.	1 . 0*

*P 0.01, [illegible]

Table 5 *C. gigas*

0	10 0	011 1 0 .1	1 $^{-1}$
0 0	G (5)	011 5 .1	$^{-1}$
1		0.1	$^{-1}$

(01). (0. 0.) (0.) 0. (1 0). 0. 11 (010). (00). 1 QT *C. gigas* (00 G 00 00, 00 010 G 01 01). QT QT *C. gigas* QT QT QT (1 0 1). G 0 0 0, 1 QT QT ( ) (001). QT (G 00). QT (1, 1). (1). G

C. gigas

C. gigas

Acknowledgements

References

Crassostrea gigas

(*Crassostrea gigas*).

(*Crassostrea gigas*).

(*Scylla paramamosain*).

(*Paralichthys olivaceus*).

(1) 1 1 1 –1
(00) *Crassostrea gigas* 0 –
(01) 1 0– 0
(00) 11 1–
(00) *Crassostrea gigas*
(00) *Haliotis discus hannai*. 1 11– 1
(010) (*Crassostrea gigas*) 10 –
(011) *Crassostrea gigas*.
(01) *Meretrix meretrix* 1 1 –
(00) (*Salmo salar*) 10
(1) 1 1 –1
(00) 1 111–11
(01) *Meretrix meretrix*. 1–
(01) 1–
(00) *Coffea*
(00) 0
(1)
(00)
(00) *Crassostrea gigas*. 0 1 –
(010) -1 (*Crassostrea gigas*). 1 0–
(01) 1 *Crassostrea gigas* 1 – 0
(1) 1 –1
(00) 1 1– 0
(1 0) (*Zea mays* .)
(1) 1 –
(001) 1 – 1 0

[illegible] (201[illegible]) [illegible] (*Crassostrea gigas*) [illegible] 1 [illegible] –1

[illegible] (200[illegible]) [illegible] 0

[illegible] (201[illegible]) [illegible]

[illegible] (200[illegible]) [illegible] 1– 0

[illegible] (1[illegible]) [illegible] 1– 1

[illegible] (201[illegible]) [illegible] *Crassostrea gigas*, [illegible]

[illegible] (201[illegible]) [illegible] *Crassostrea gigas* [illegible] 1 [illegible] –1