Aquaculture 482 (2018) 73–77

C t ts sts t D t

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journal homepage: www.elsevier.com/locate/aquaculture

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t t st t t t w t s t t t w t -s st fi st , *Crassostrea gigas*

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A C E F

Keywords:
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Crassostrea gigas
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A B A C

fi st (*Crassostrea gigas*) s t st w t s s t t . *C. gigas* s s s w t t t t tt . t s st , t t t t t ts t w t s t t w t -s st *C. gigas* w t - t . A t t 460 ffs s t s w s ss ss t t ts s t C t s s 11 s t t . t t w s s ss t t s s t t t s s. A t t st t w 0.215 0.092 t t t . t t t s tw tw t t ts w 0.980 0.094 0.423 0.042, s t . s s s t s t t s s w st s fi t t ($r = 0.729$, $P = 0.000$, $= 29$). C -s s s s w t t t t t 7 s t t “ t ” “ ” s 3:1 t ($P = 0.833$), s st t t s t t t t t t. s ts t t s st w fit s t *C. gigas* w t s t s t t .

1. Introduction

t t s s w t ff t s - s w ss t , s t t s w t ts fl t s t t t fi t (C s , 1993). F - , s s w t s s fi ts w t (A s t ., 2006). , t s t t fi st (*Crassostrea gigas*), w s s s - -s s t -s t st ts ts, s fl s s. fi st w t s t t s t t s t t st s (, 2001). , t fi st w t t s t t t 20% (t ., 2013). t s s t t s t s s w t t t ts tt . s t t fi st , w t -s st st s t t t s - s s t . t st w t -s st s ws t t , w t w w t . fi st s t t st t s t s -w t , t- s s t - , t s s, w st s s t s fi st s t t s t t t t t t t (B t ., 2004; , 1961), t st st t s t t t s t t s t t -s s w-s s t t t-s t t w (E s t ., 2009). s ts t t st s s t t t s s t t t- s t ff t tt s w t st (E s t ., 2009; t ., 2015). s t t t s s t t (t, 2004), t s t t t t s s t t (B t ., 2004; t ., 2013), s st t t t t s sts - tw t s t t , t t t t s t t *C. gigas*. t , s st s t s s s t ts t *C. gigas* (t ., 2015; F t ., 2015), t t s t fi t t t t t t t . t t *C. gigas* w s s t s st t , t t s s (B t ., 2004; t ., 2013), t t s st s w t t t t t

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tt ://. . /10.1016/ , t .2017.09.026
10 2017; s 30 A st 2017; A t 16 t 2017
Available online 18 September 2017
0044-8486/

t s s s t ss ss ts . , w t s t t s t t t . t t s t s s t s st s w fi t (t ., 2015), t t t t ss t t t t t t t t t s s t. t s st , t t t t t s t t t ss t t w s st t w t - , t tw t s t t w s t t -s st *C. gigas*, w t t t ffi t s t .

2. Materials and methods

2.1. Spawning and nursery protocol

2010, w t -s - *C. gigas* w s t w - t s , , C , s t st s t fi st- t s t s w t s wt . 2011–2013, t s - t , t - t t - t s t w st t , s t s s t t s t 10%. t , t st s w t s s s ts t st s s . s t *C. gigas* s t t t w t -s s w t s , t t t t t , C . s 30 s w s t t 30 s w st -s t - s (w s t w t t ff t s). E s s t s t . A t s s s t s w t st 70% t D A s s. F t s w t 24 t t t 24 C s t 30 s , t t t D-s s w t 500 st t t. B , s t w s t . w s s t . (2015). B fl , t s t w s st t 15 / , t 5 / 1 / 7 14 t t t , - s t . w t w s tw w t s fi t s w t t 25 C. w s w t t s *Isochrysis galbana* t t 120 μ s t , t s w t t s C t s t s t s t st . s ts , st s s s s w t t t s s st t s. A t w , s - ss t s W s t w t s t t s t . A t 30 , s t w s t t s t s t t w- t s s , C (36.89 , 121.52 E).

2.2. Shell and mantle edge pigmentation measurement

A ffs w t t 24 t s , t w w s s , t s w s t 70% t D A s s s 0.100 t w s t ss t t. t w s s t s t w t t t t . As s C t t . (1998), s s t w t t s t 1 1.0 . s s t s s w 5 w t A 10 s t w t t 30 . A t , s s s s w t t t 10,000 10 . t ts w t s s t t t - s s t t t t t 500 s (A500). t , s t t t w t -721 – s s t t t , w - t , t ss w s s t t 1 . w t s tt w s 500 . A s s t ts t t tt s w t t s. A500 s t s t t , . . t t t s. s s ffs w s w t s w t , s 6% s t s t 2 t t t (t t ., 2006), t s s . t s s t E s t . (2009). A t (D80) w s s t s w t tw s W t t s s. B s s st t - t t . s w t tt - t fl t s. A s w t w t t t s t s w s - s s s s tw 6.0 (C t s ., s, A). - s /C t/s / A st w s s t t t st s s t - t , t t t st (A); t s t t w s s t t t . t D s t , s w s t t t s t , s 0 (t w t) t 2.4 (t). t s t (D) s s w s s s s s t t s s.

2.3. Parentage assignment

D A t t s s w s t t w t . (2006). F t C t s s 11 s t t (C -117, C -120 C -198; C -146, C 3 s C -210; t 0 0129 E11, t 0 0007 B07 C 4; C -200 t 0 408293) (t ., 2017) w s t t t ts . t ss t w s s - A 8–5.1 (tt t ., 2006). s st ss t ffs t t t t s (- t t s), w t t t ss t t t t s t s (= t s s - - ff- s t t) t t t t t s (tt t ., 2006). t t , ss t t s t s w w t st 95% - fi w t .

2.4. Data analysis

s tw A 3.0 (t ., 2009) w s s t st t t t t (h^2) t t t s ($r_{P/G}$). A t tw t ts (s t t t) w t st st t . t t t t w tt s:

$$y = Xb + Z_1a + Z_2c + Z_3d + e \quad \text{(Model 1)}$$

w y s t t s t s s, b s t t fi ff ts, a s t t t ff ts, c s t t t / t ff ts -s t t t t s, d s t t ff ts, e s t s ff ts.

st t st s fi t ff ts t t w s ss ss t (-) t st (t ., 2009) t t st t (L). t s s s, c d w t s fi t w 1. w s s ws:

$$y = Xb + Za + e \quad \text{(Model 2)}$$

t 2, st t s t t w t s $h^2 = \sigma_a^2/(\sigma_a^2 + \sigma_e^2)$, w σ_a^2 s t t t σ_e^2 s t s . t t t s tw tw t ts w t s $r_{P/G} = \sigma_{12}/\sqrt{\sigma_1^2}.\sqrt{\sigma_2^2}$, w σ_{12} s st - t t t t tw t tw t ts, σ_1^2 σ_2^2 t t t t s t ts 1 2, s t .

A t st s - s s w

Table 1
ffs ss t t 30 s, s s t t t , t s t t .

	D									
1	1	11	0.427	0.109				0.669	0.054	
	2	4	0.546	0.154				0.674	0.017	
	3	11	0.399	0.115				0.659	0.033	
2	4	22	0.603	0.208				0.782	0.102	
	5	0	–					–		
	6	8	0.603	0.159				0.797	0.116	
3	7	30	0.425	0.177				0.708	0.081	
	8	23	0.439	0.127				0.738	0.121	
	9	12	0.624	0.179				0.718	0.109	
4	10	6	0.520	0.136				0.674	0.030	
	11	6	0.605	0.275				0.728	0.087	
	12	2	0.504	0.199				0.756	0.090	
5	13	15	0.621	0.178				0.782	0.107	
	14	2	0.440	0.138				0.702	0.008	
	15	17	0.632	0.270				0.810	0.144	
6	16	18	0.516	0.193				0.705	0.102	
	17	1	0.255					0.619		
	18	11	0.513	0.208				0.760	0.086	
7	19	22	0.427	0.120				0.709	0.099	
	20	7	0.400	0.123				0.686	0.049	
	21	7	0.562	0.145				0.811	0.114	
8	22	4	0.529	0.412				0.691	0.099	
	23	46	0.513	0.179				0.762	0.120	
	24	35	0.469	0.173				0.699	0.091	
9	25	46	0.539	0.159				0.737	0.102	
	26	20	0.635	0.229				0.807	0.131	
	27	12	0.565	0.161				0.748	0.136	
10	28	12	0.427	0.105				0.722	0.125	
	29	5	0.523	0.175				0.776	0.121	
	30	45	0.562	0.188				0.726	0.129	
t		460	0.520	0.189				0.737	0.112	

s t t st st t s t t t w t . t s st t s s w s t t ss s, -s W s s w s s t t w t t s s t t s ff s t - t s s s.

3. Results

3.1. Parentage assignment and summary statistic in families

A t t 528 w t ss t, w 460 s ss ss t 29 t 30 t t s (1). F 68 ss , fi - t t t t s s t s ffi t ss t. A s t t t s w s , w t 0–46 . s t t s - t t t w s 1.

3.2. Heritability and correlation

t t s st t s s t fi (2) st 2. t t t st t s w s t tw t ts. t t t t t (0.215 0.092) w s s t t t t s t t (0.156 0.078). t t tw t s t t w s st (0.980 0.094), t t w s t (0.423 0.042). s - s s t s t t t s s s w st s fi t t ($r = 0.729$, $P = 0.000$, = 29) (F . 1).

st s t st t s t - t t w st t w t 18 s (F . 2), w ffs w t t . t t w s t t s st t w t st t s.

Table 2
A s s s t ts t t (t t, t t t) st t s t s t t w t -s st fi st, s 2.

A ( )	0.00777		0.00196	
s ( )	0.0284		0.0106	
t t E	0.215	0.092	0.156	0.078
A t ((1, 2))	0.00383			
s ((1, 2))	0.00521			
t t E	0.980	0.094		
t t E	0.423	0.042		

w , - s s s w t t t s s fi t - st t s ($P < 0.05$). F 15 30 s w s w st t , w 7 s w st t s w t t -s s s s t s (“ t ” “ ”). C - s s s s w t t t s “ t ” “ ” t s t ff s fi t 3:1 ($\chi^2 = 0.044$, = 30, $P = 0.833$).

4. Discussion

t w t s st s, t t t s s s t t t t t s t t (B t ., 2004; t ., 2013). t , t t t w ss fi t ff t s s. B t t s t s t t t s - s t. t t t t ss t t s w s t t t s t t ss s t - s, t s (C t t ., 1998; t t ., 2011; t ., 2001; t ., 1995). t t s t st , w

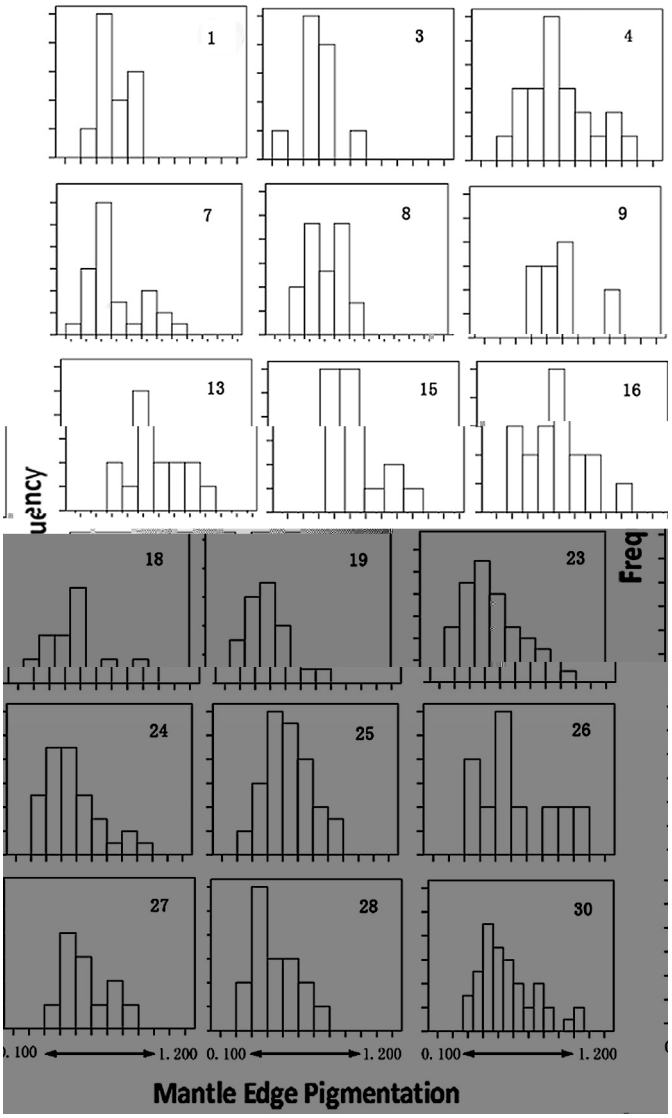

Fig. 2. D st t t t t s w t 18 -s s (= 11 t 46). t t s t - s st A500 = 0.100 (t st t) t A500 = 1.200 (st t).

t " " . s s t s s st t w t t t s t t t t t t t t s ss t s (E s t ., 2009). F t w s t fi t st s - t tw t t ts *C. gigas*.

5. Conclusion

s st st t t t s t - t t *C. gigas* s t t t ss t t - t t. t t t t t t tw t s t t t t t s ff t t t t t t s t , t s t t t s t t t t s . st s s t s t *C. gigas* w t s t s t t .

Acknowledgements

s st w s s t ts t t F t C (31772843), (2016 DJ 06A06), s s t , st D t t C t (17-3-3-64- s).

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