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DNA

(QTL)

(PHS)

QTL

PHS

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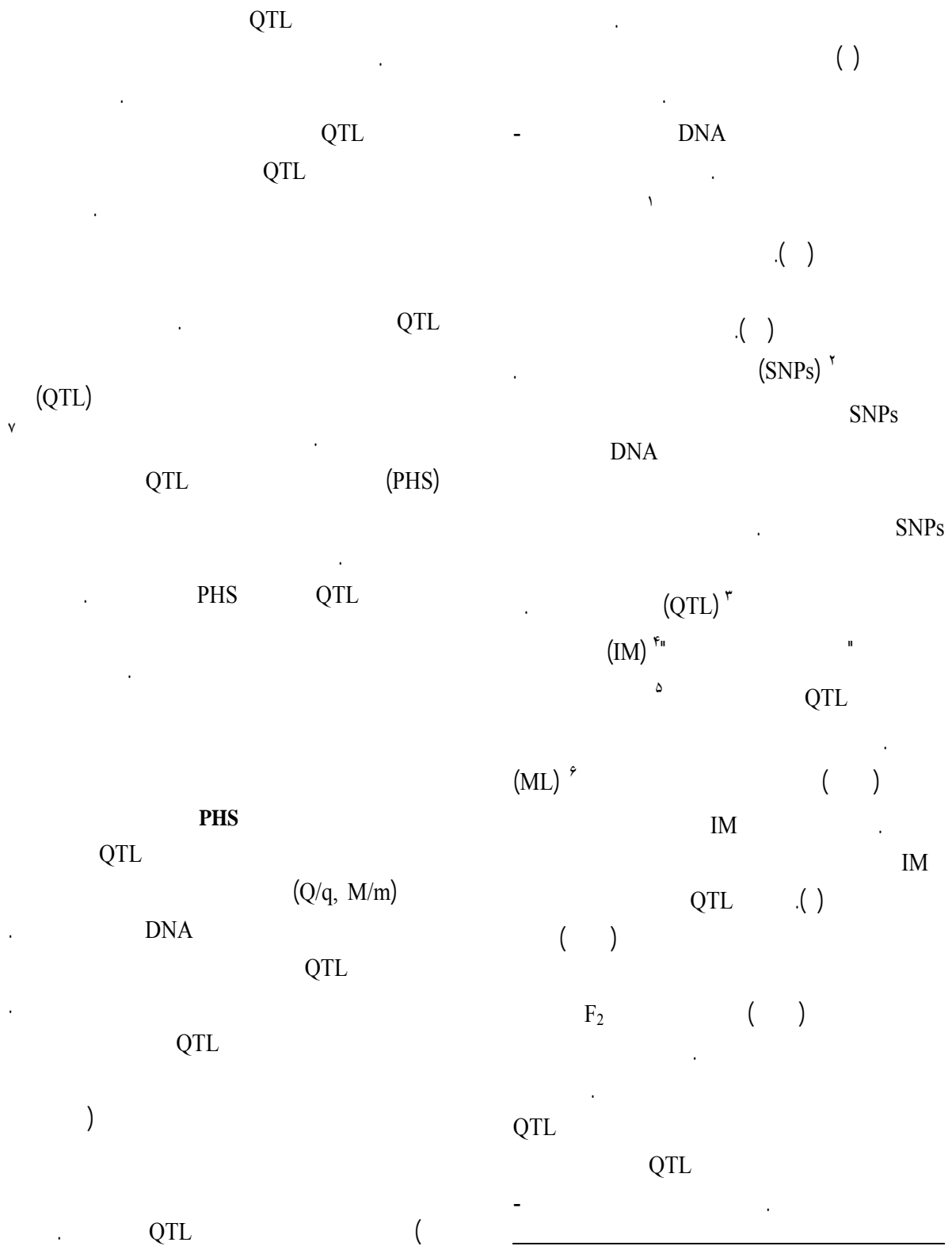
DNA

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DNA



-
1. Microsatellite
 2. Single nucleotide polymorphisms
 3. Quantitative trait loci
 4. Interval mapping
 5. Marker-bracket
 6. Maximum likelihood

α r)

(

QTL (r)
 (α) QTL

PHS

QTL

()

QTL

QTL

QTL

(M₁m₁, Qq, M₂m₂)

M₁M₂,)

(M₁m₂, m₁M₂, m₁m₂)

$\mu + \alpha$	$(1-r)/2$	Q	M
μ	$r/2$	q	M
$\mu + \alpha$	$r/2$	Q	m
μ	$(1-r)/2$	q	m

=r

= μ

= α

QTL

(Q) QTL

$$P(Q | m_i m_j) = \frac{P(m_i Q m_j)}{P(m_i m_j)}$$

(

m

M

Q

P(Q|m_im_j)

M

$$= \mu + \alpha(1-r)$$

(

m_iQm_j

P(m_iQm_j)

m

$$= \mu + \alpha r$$

(

m_im_j

P(m_im_j)

:

$$\bar{y}_M - \bar{y}_m = (1-2r)\alpha$$

(

(r)

(r)

(r)

QTL

QTL

QTL

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QTL

r

QTL

QTL

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(Q)

(m M)

QTL

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() QTL

α r

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α r

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QTL

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QTL

(α r)

QTL

QTL

QTL

QTL

QTL

QTL

p

$$) / <p < /$$

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$$(pq= \times / \times / = /) / (h)$$

s

QTL

(h)^s

/

$$h= /$$

QTL

(Q) QTL

cM	cM		
$r = /$	$r = /$		
$r = /$	$r = /$		
$r_2 = /$	$r_2 = /$		
$/$	$/$	$(1-r_1)(1-r_2) / (1-r_{12})$	P(Q M1M2)
$/$	$/$	$(1-r_1)r_2 / r_{12}$	P(Q M1m2)
$/$	$/$	$r_1(1-r_2) / r_{12}$	P(Q m1M2)
$/$	$/$	$r_1r_2 / (1-r_{12})$	P(Q m1m2)

()

QTL

$$= r \quad r$$

$$= r$$

QTL

QTL

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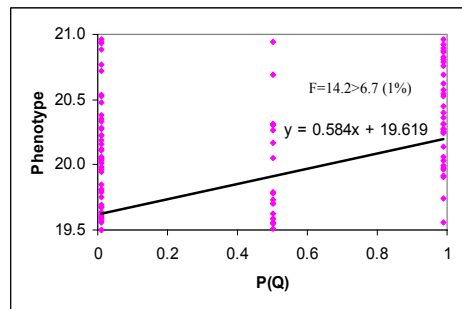
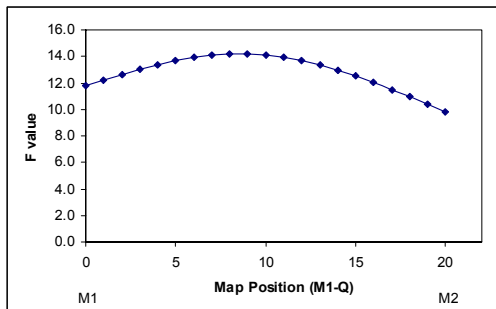
n/

$$Var(D) = \frac{2\sigma^2}{n/2} = \frac{4\sigma^2}{n}$$

:

t

$$\frac{D}{(2\sigma/\sqrt{n})}$$



()

F

.Q

()

QTL

(α)

IM

() ML

(QTL)

(QTL)

(LR) ' (LOD) ' IM

$y_{ij} = \mu + \alpha X + e_{ij}$ (

$\gamma = 1 - (1 - \alpha)^n$

(n) QTL α (

$P(Q|m_1 m_2, r_1, Q X e_{r12})$

() QTL QTL

() QTL

(.) QTL

(SS_E)

QTL LR F SS_E

F () ML LR

LR = $n \ln(RSS_r / RSS_f)$ (

RSS_r n

RSS_f QTL

QTL

-
3. Multiple testing
 4. Permutation test
 5. Empirical test

-
1. Likelihood ratio
 2. Logarithm of the odds

() QTL () QTL

N N QTL

(×) QTL

() QTL

() QTL

() QTL

/ SD=) QTL QTL

(/ SD= / SD= (

QTL QTL (/ SD=)

y () QTL

() QTL (/ SD)

QTL ()

QTL
)
 QTL
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QTL

QTL	
$\alpha = /$	$\alpha = /$
/	/
/	/
/	/

() QTL ()
)
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QTL				QTL			
/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/

= QTL
 = / SD=

cM cM
) QTL
 ()
 QTL

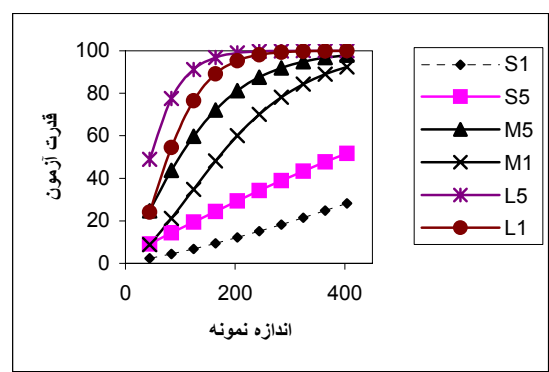
QTL

QTL
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 QTL
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QTL
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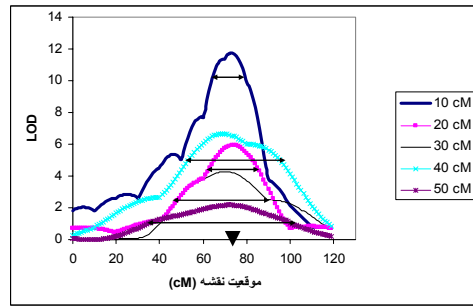
QTL
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QTL

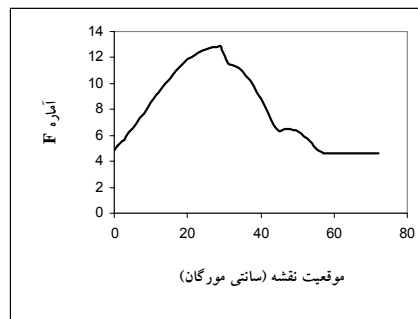
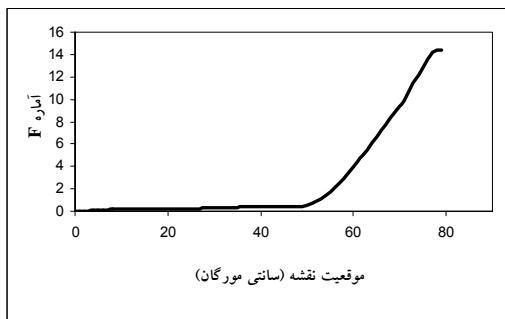


QTL
 QTL S5.QTL
 QTL S1 %
 M1 % QTL M5 %
 QTL L5 % QTL L1 %
 .%

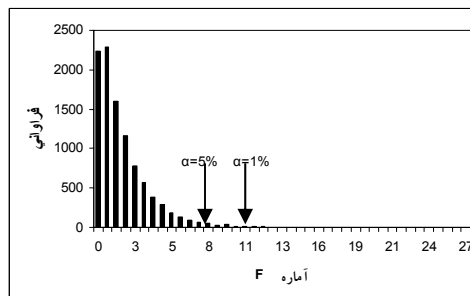
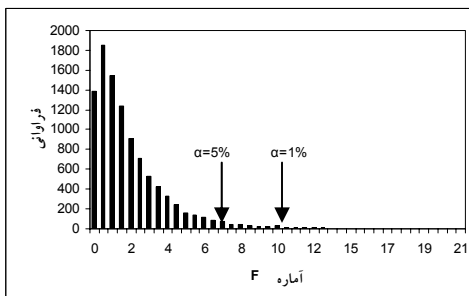
IC
 QTL
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 IC ()



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 QTL QTL
 QTL
 QTL
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() F ()



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QTL

QTL

QTL ()

QTL ()

LOD	LR	F	QTL ()	QTL #
/	/	/**	(/)	
/	/	/**	(/)	

#

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QTL ()

QTL

QTL ()

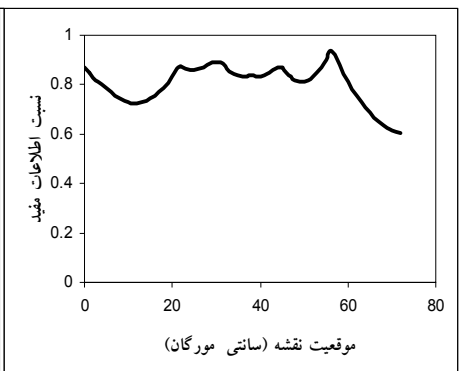
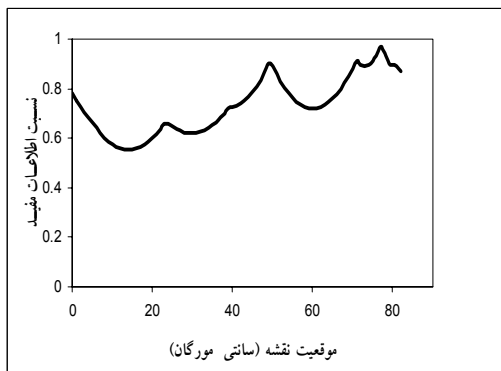
QTL

QTL ()

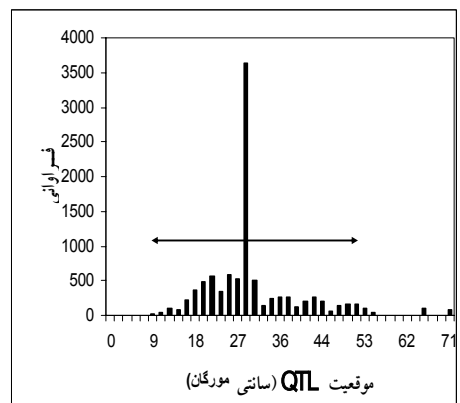
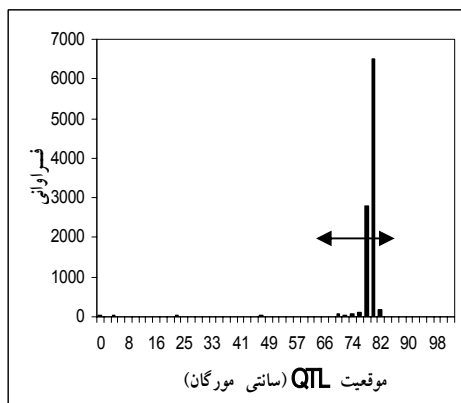
QTL

QTL

QTL



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QTL

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QTL

QTL () ()

QTL ()

() () QTL

QTL Myc

QTL () ()

() ()

QTL ()

) QTL ML

(<http://qtl.cap.ed.ac.uk>)

(<http://www.genenetwork.org>) QTL

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