



Genetic basis of summer mortality in juvenile cupped oysters

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Summer mortality in juvenile Pacific oysters

- Reported for many years and in several countries
(Koganezawa, 1975 ; Glude, 1975 ; Gouilletquer et al., 1998, Cheney et al., 2000...)
- “MOREST”
 - a multidisciplinary program to better understand and face summer mortality
 - pathogens,
 - environmental factors,
 - pollutants...

Genetics objectives : Determine if selective breeding programs could improve survival

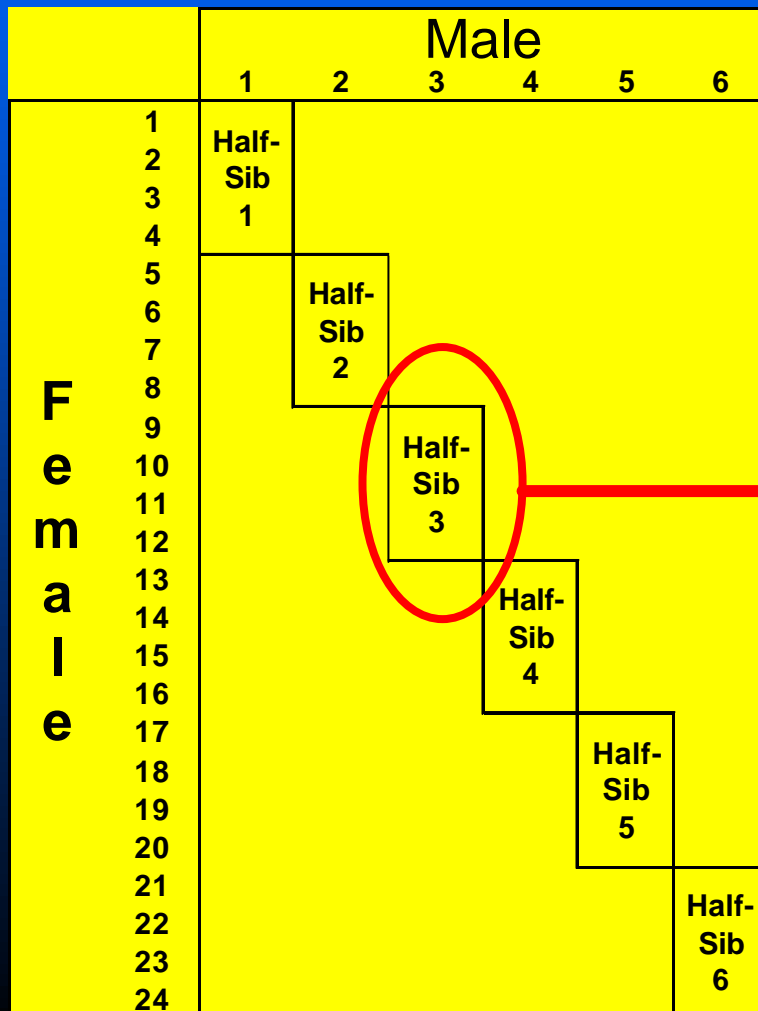
This talk :

- First generation (G1) :
 - survival in the field
 - variance components for survival
 - genetic parameters of survival
- Second generation (G2) :
 - divergent selection :
 - » trial in laboratory
 - » trial in the field : response to selection
 - inbred lines :
 - » trials in the field and laboratory



First generation (G1): material and methods

- 3 sets of 24 nested half-sib crosses giving 72 full-sib families



Half-sib family 3

- Family 3-9
 - Family 3-10
 - Family 3-11
 - Family 3-12
- 4 full-sib families

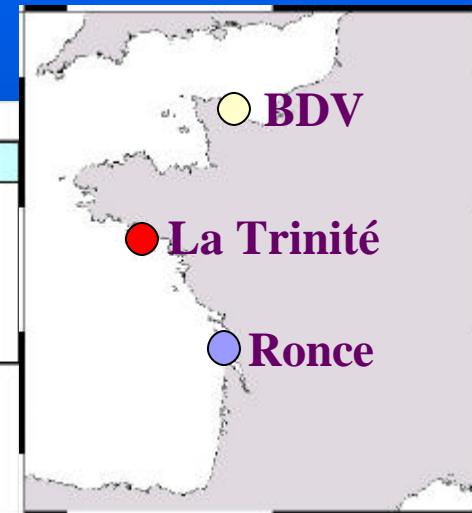
Determination of genetic parameters
(ANOVA - REML using SAS system)

G1 : material and methods

- 3 x 15 = 45 families tested in 3 sites

Time schedule : 3 successive sets

	févr-01	mars-01	avr-01	mai-01	juin-01	juil-01	août-01	sept-01	oct-01
Set 1	0-16	17-43	44-134			135-239			
Set 2		0-16	17-43	44-121		122-211			
Set 3			0-16	17-41	42-107		108-164		
	Larval rearing		Nursing		Numbers indicate the days after fertilization				
	Setting		Field						



- Recorded traits :
 - survival and growth 2 and 4 weeks after placement in the field
 - survival and growth at the end of the growing season
- 3 bags / family / site / sample = 1215 bags of 150 oysters**

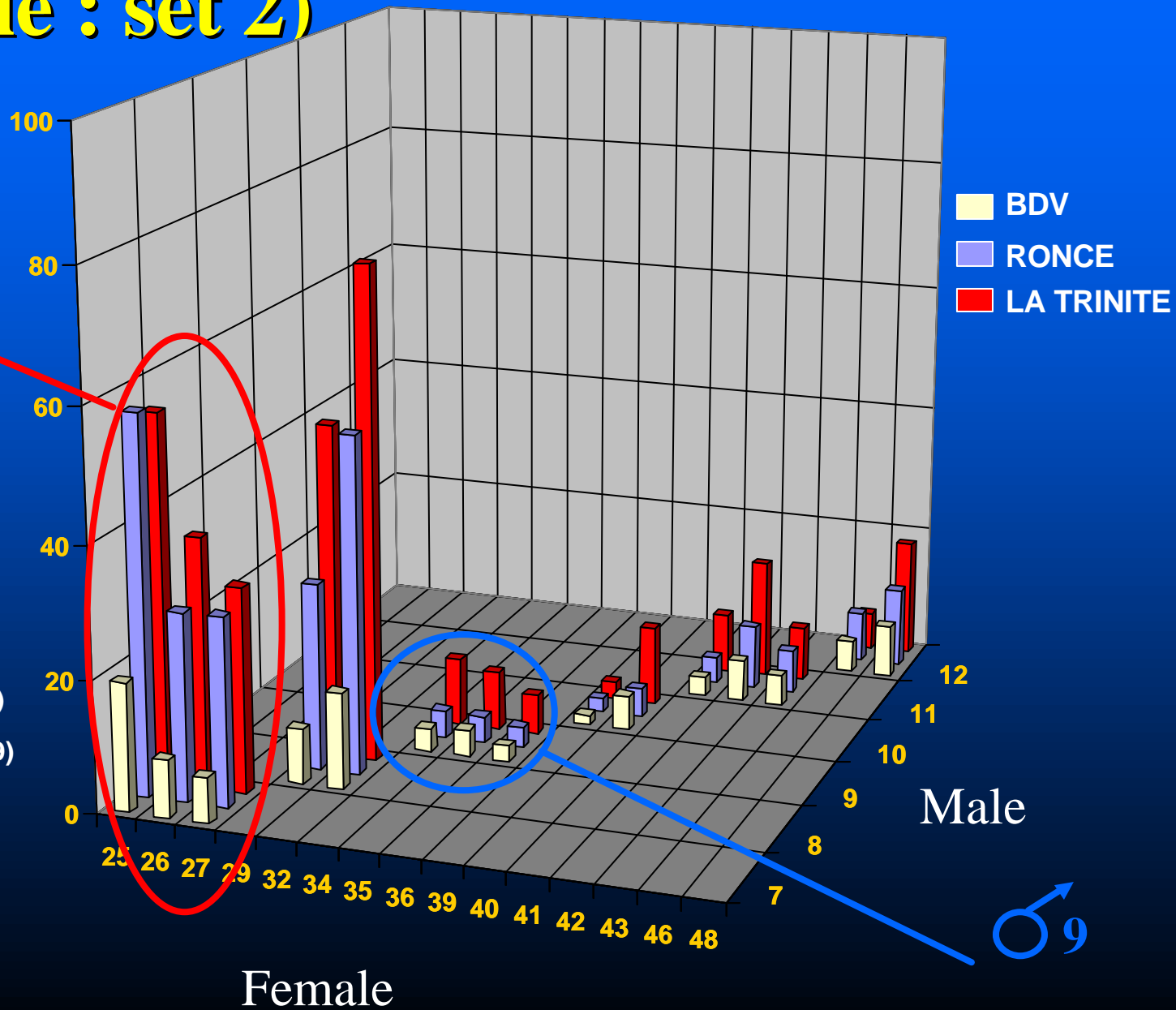
G1 : mortality in the field (example : set 2)

♂₇

Mortality (%)

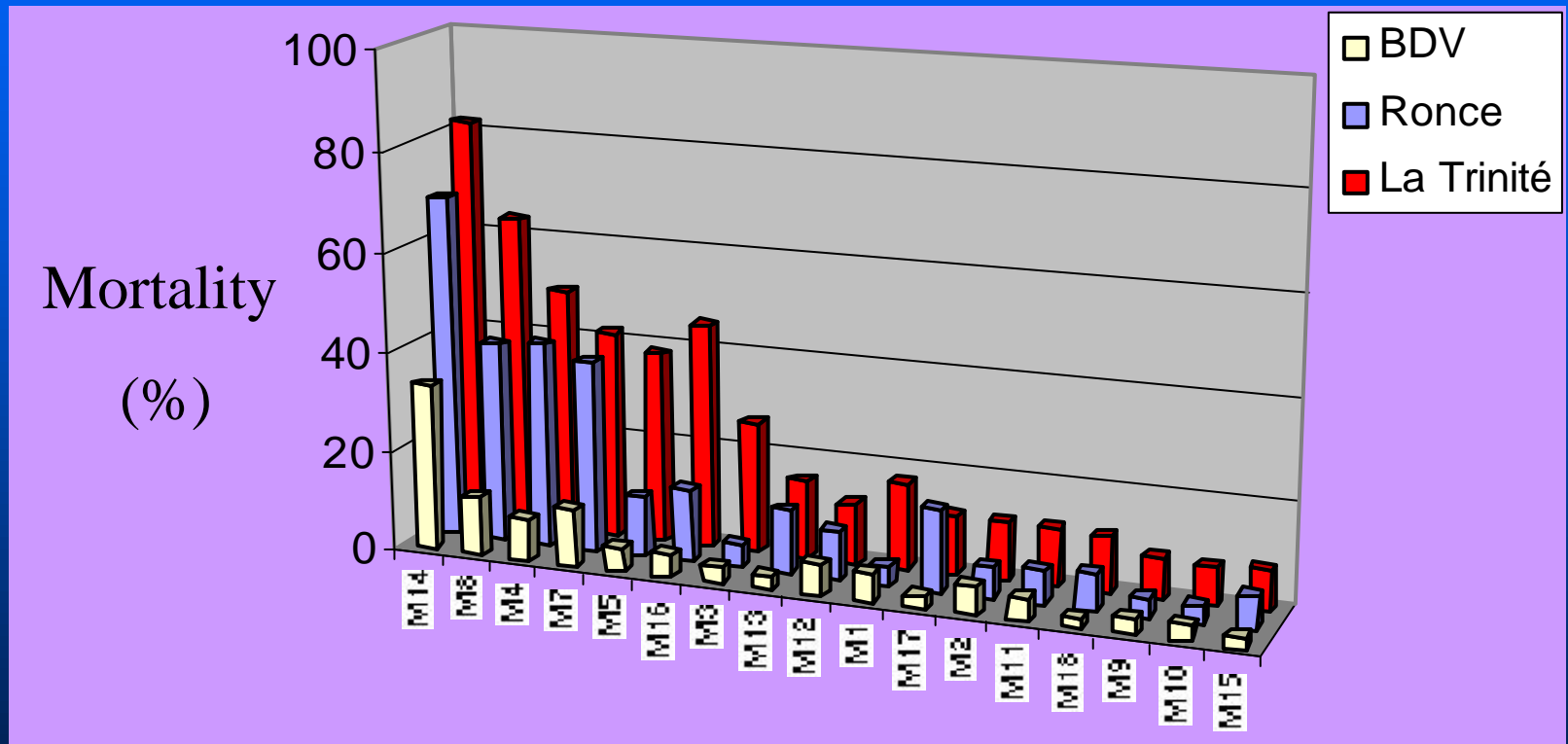
BDV
RONCE
LA TRINITE

Set 2, 19 July 2001 (day 15)
Set 2, 7 August 2001 (day 30)
Set 2, 2 October 2001 (day 89)



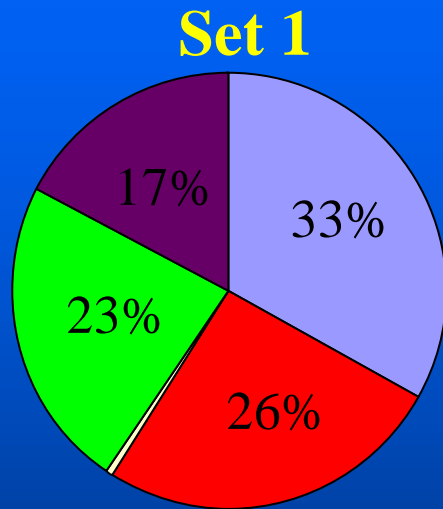
G1: mortality in the field - October 2001

mean values per male and per site

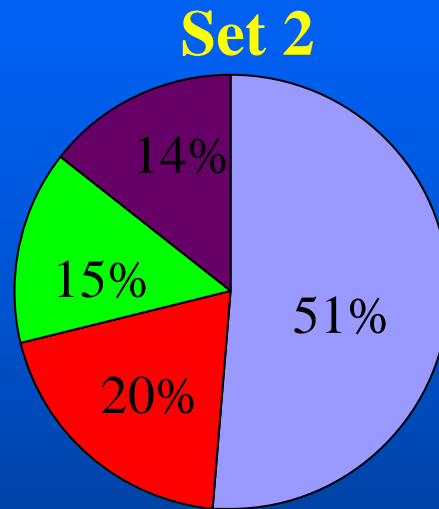


- Differences among sites
- Differences among males → Important genetic basis for survival

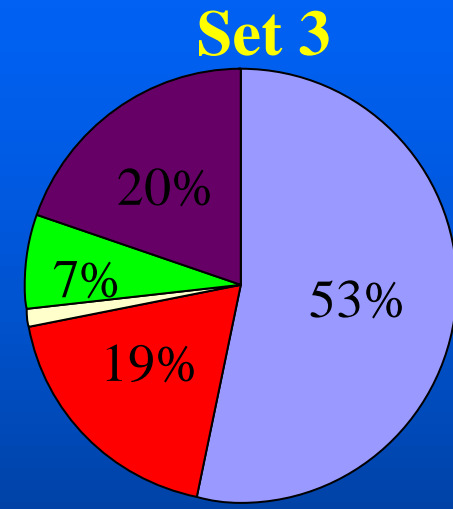
G1 : variance components for survival



$$h^2 = 0.23 \pm 0.35$$



$$h^2 = 0.85 \pm 0.46$$



$$h^2 = 1.21 \pm 0.57$$

Family $p < 0.01$

Site $p < 0.01$

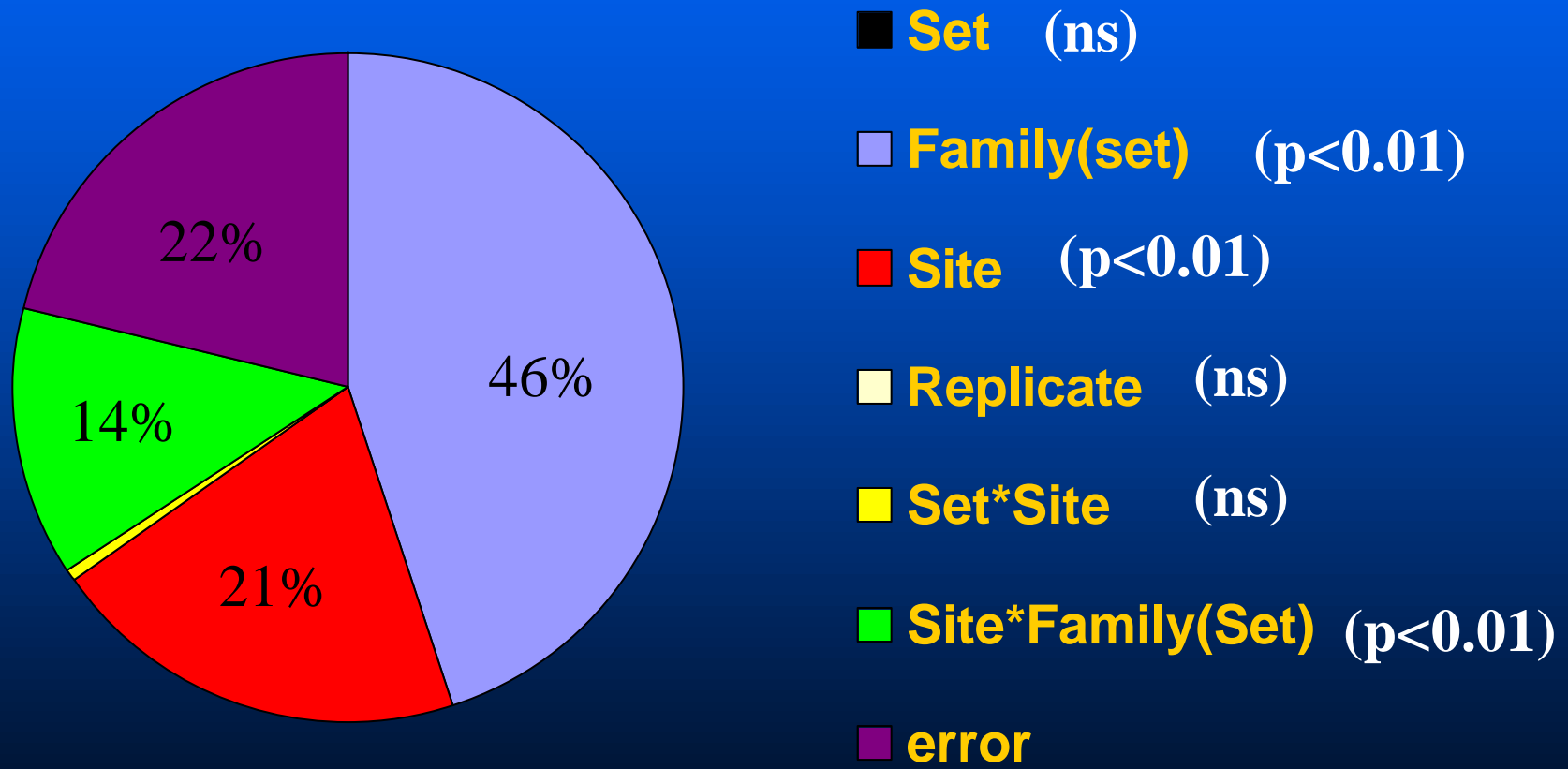
Replicate ns

Family*Site $p < 0.01$

error

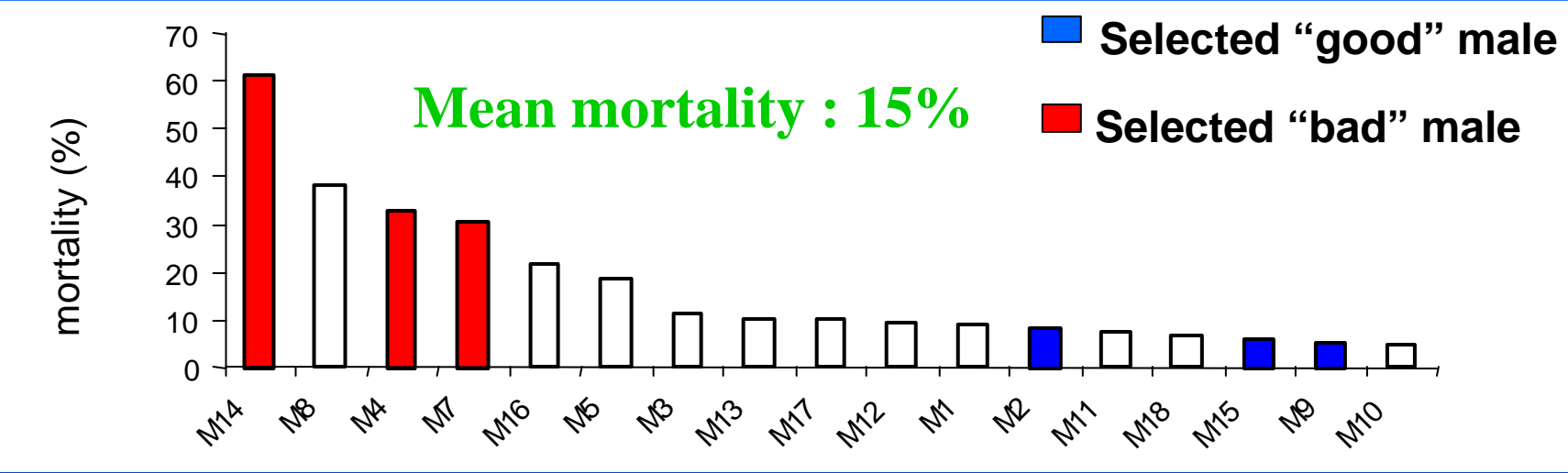
(h^2 = narrow sense heritability)

G1 : variance components for survival overall sets - October 2001



$$h^2 = 0.81 \pm 0.29$$

Second generation : divergent selection 2002



Mortality : 43%
S = 28 %

Mortality : 4%
S = 11 %

Low selected group : 12 families

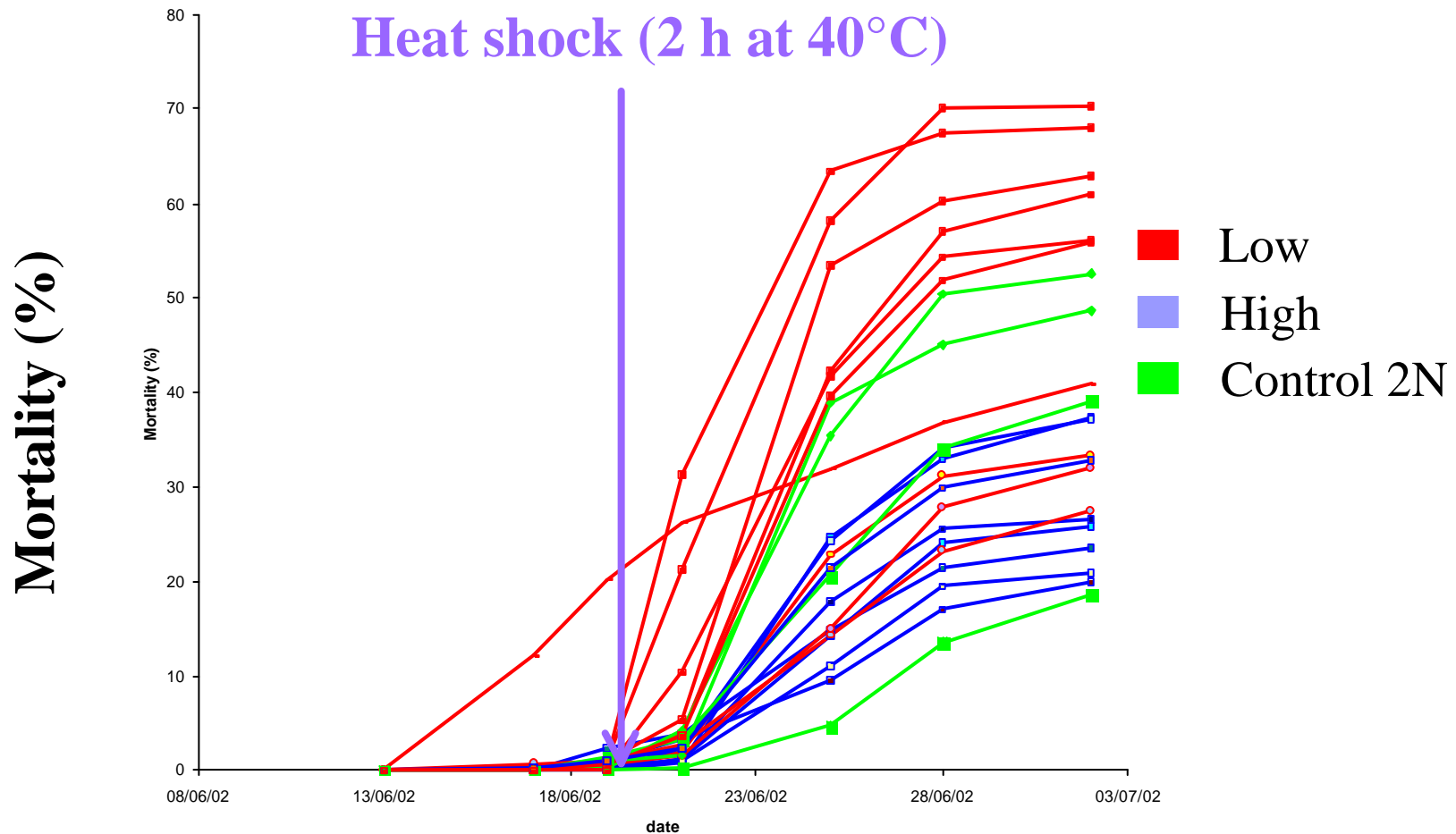
High selected group : 12 families

Male	4	7	14			
Family	F4-15	F4-16	F7-25	F7-26	F14-54	F14-55
4	F4-15		13	14	17	18
	F4-16		15	16	19	20
7	F7-25				21	22
	F7-26				23	24
14	F14-54					
	F14-55					

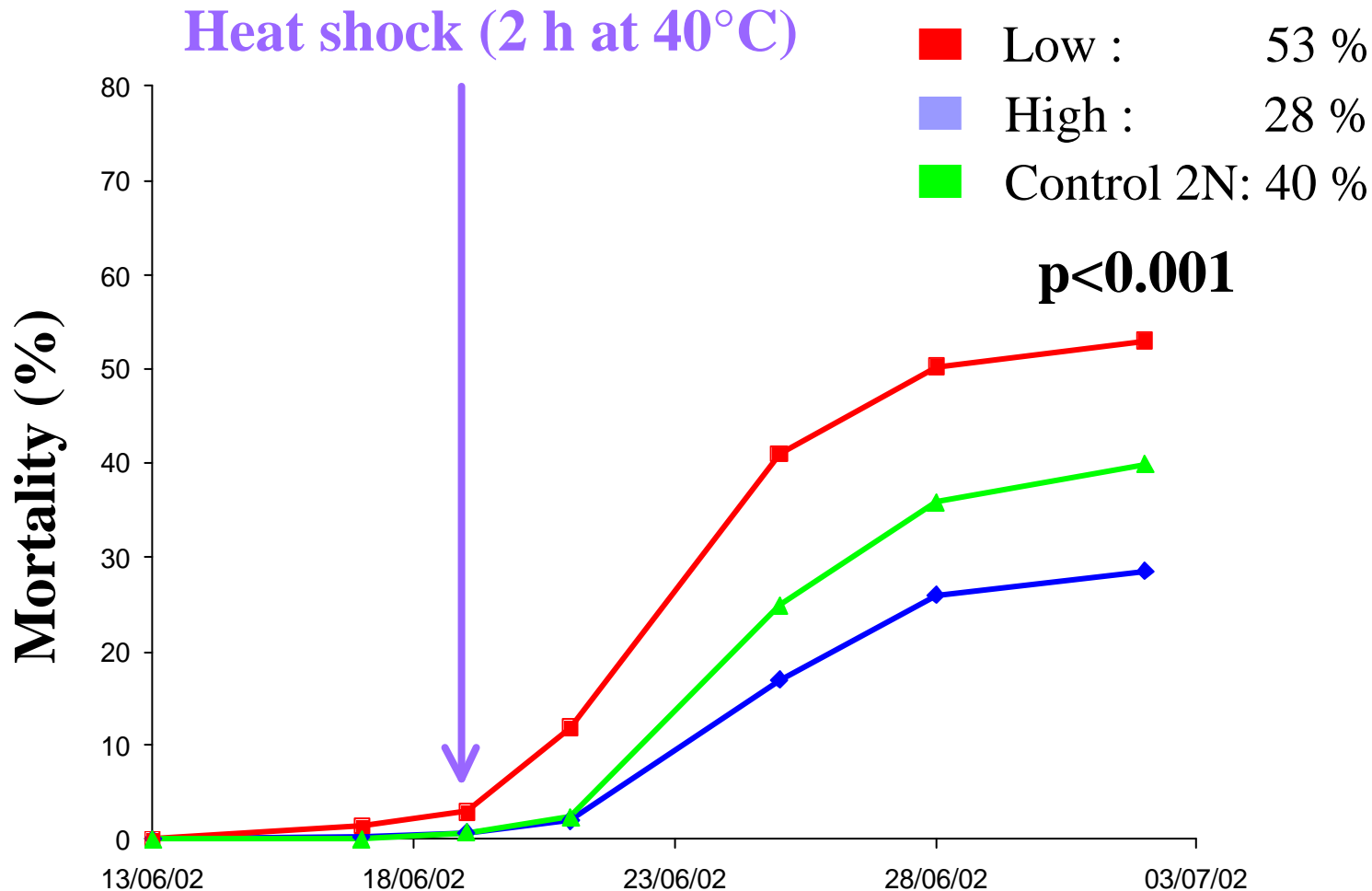
Male	2	9	15			
Family	F2-5	F2-8	F9-35	F9-36	F15-57	F15-58
2	F2-5		1	2	5	6
	F2-8		3	4	7	8
9	F9-35				9	10
	F9-36				11	12
15	F15-57					
	F15-58					

Hatchery control : 2N and 3N

G2 divergente selection : mortality *in labo* 2002 :

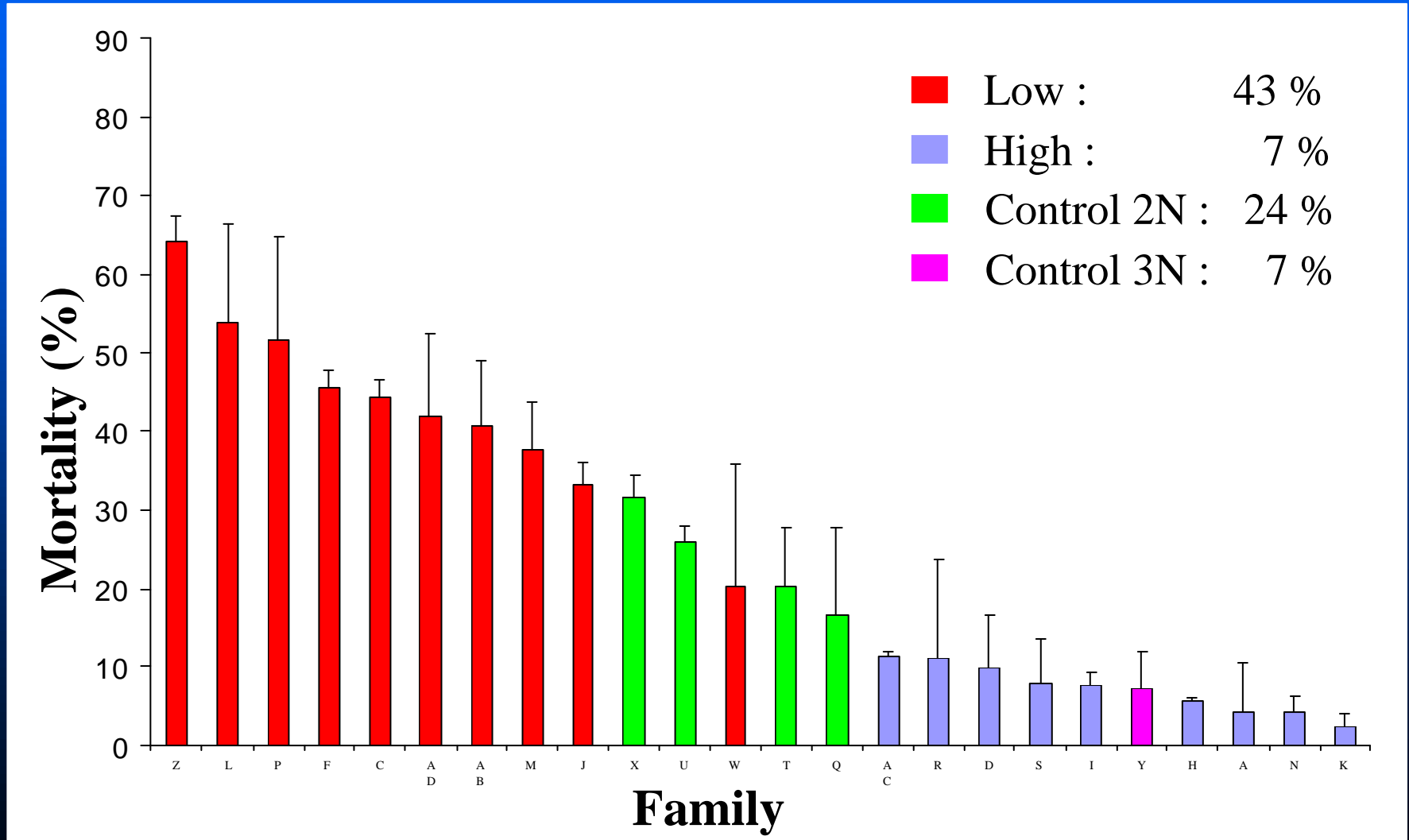


G2 divergente selection : mortality *in labo* 2002 :

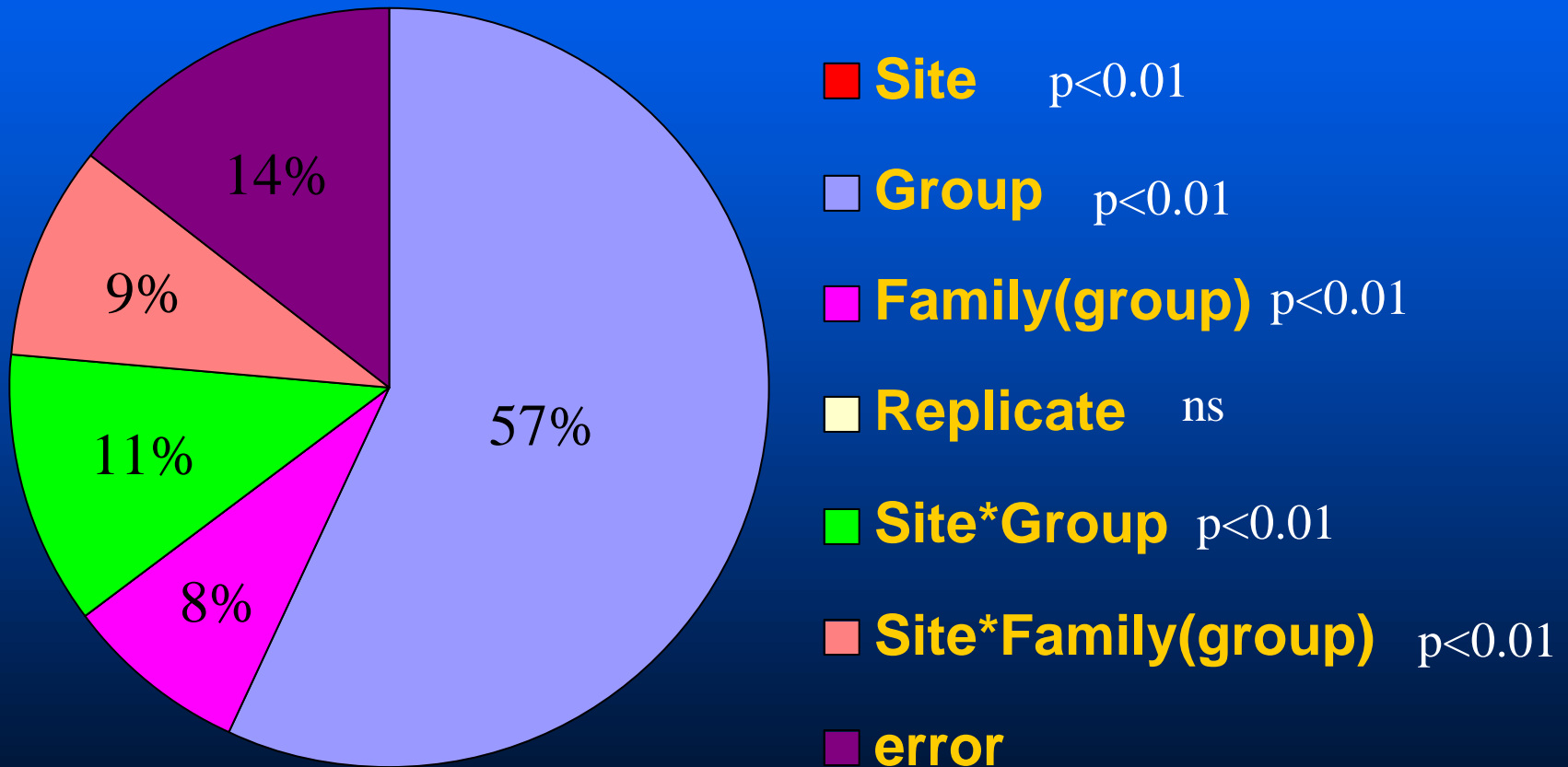


G2 divergente selection : mortality in the field

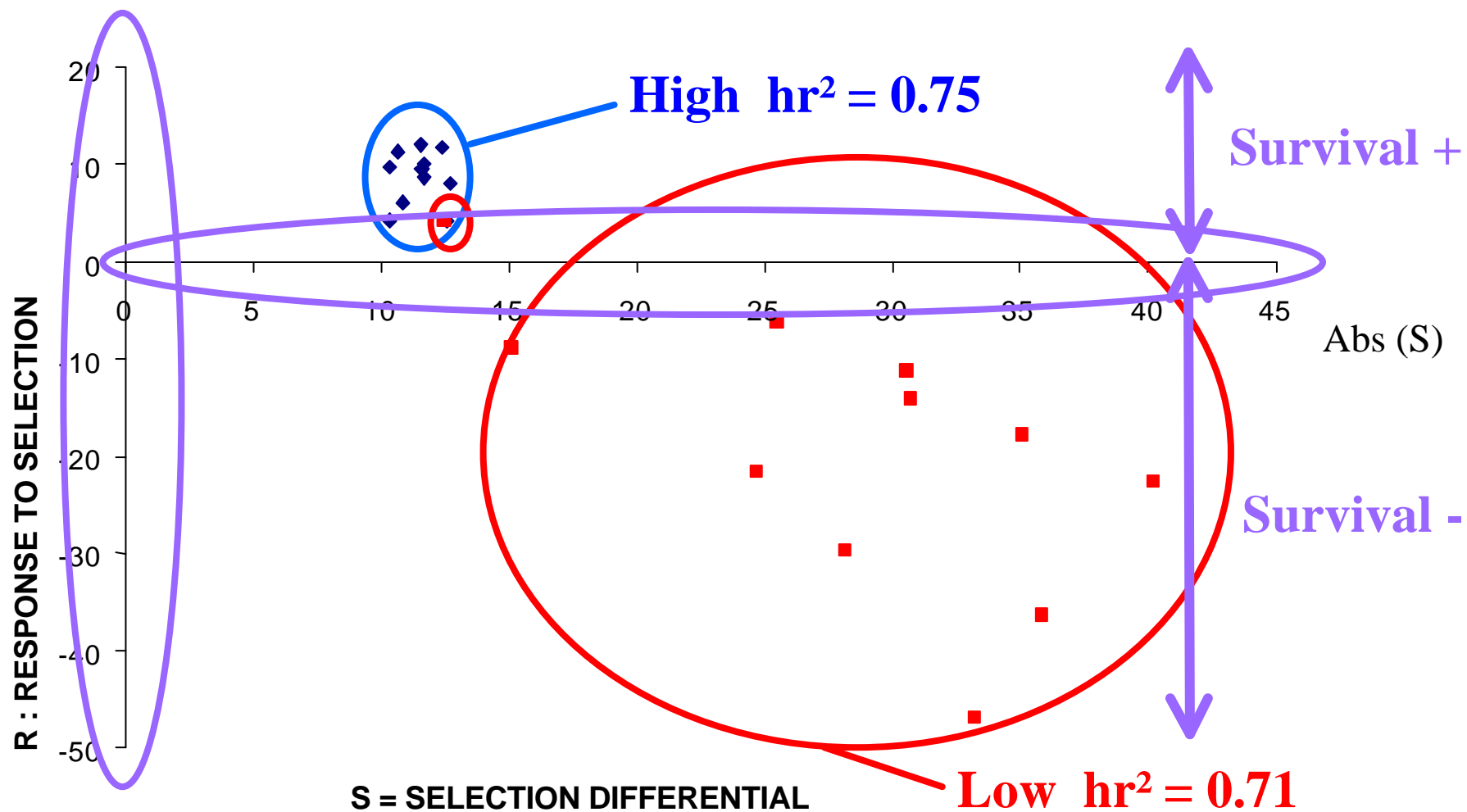
Site : La Trinité (South Brittany)



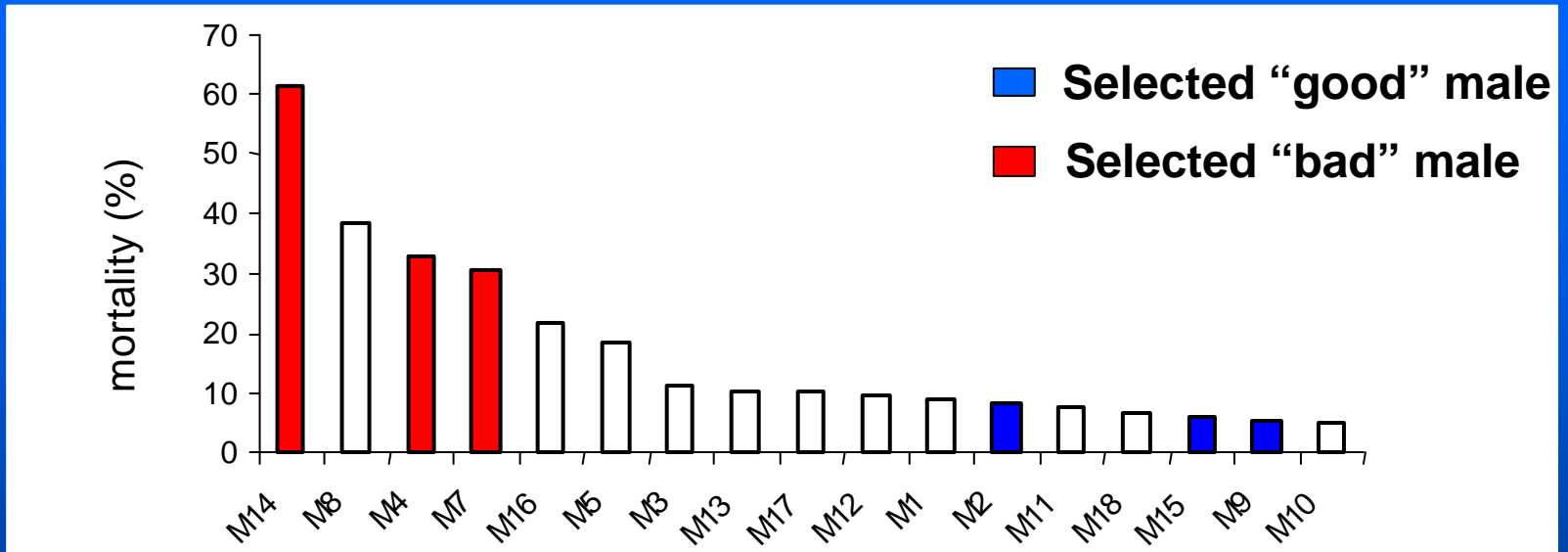
■ G2 divergent selection : variance components for survival - October 2002



Response to selection for survival in the field :



G2 : Inbred lines



Hatchery Control :

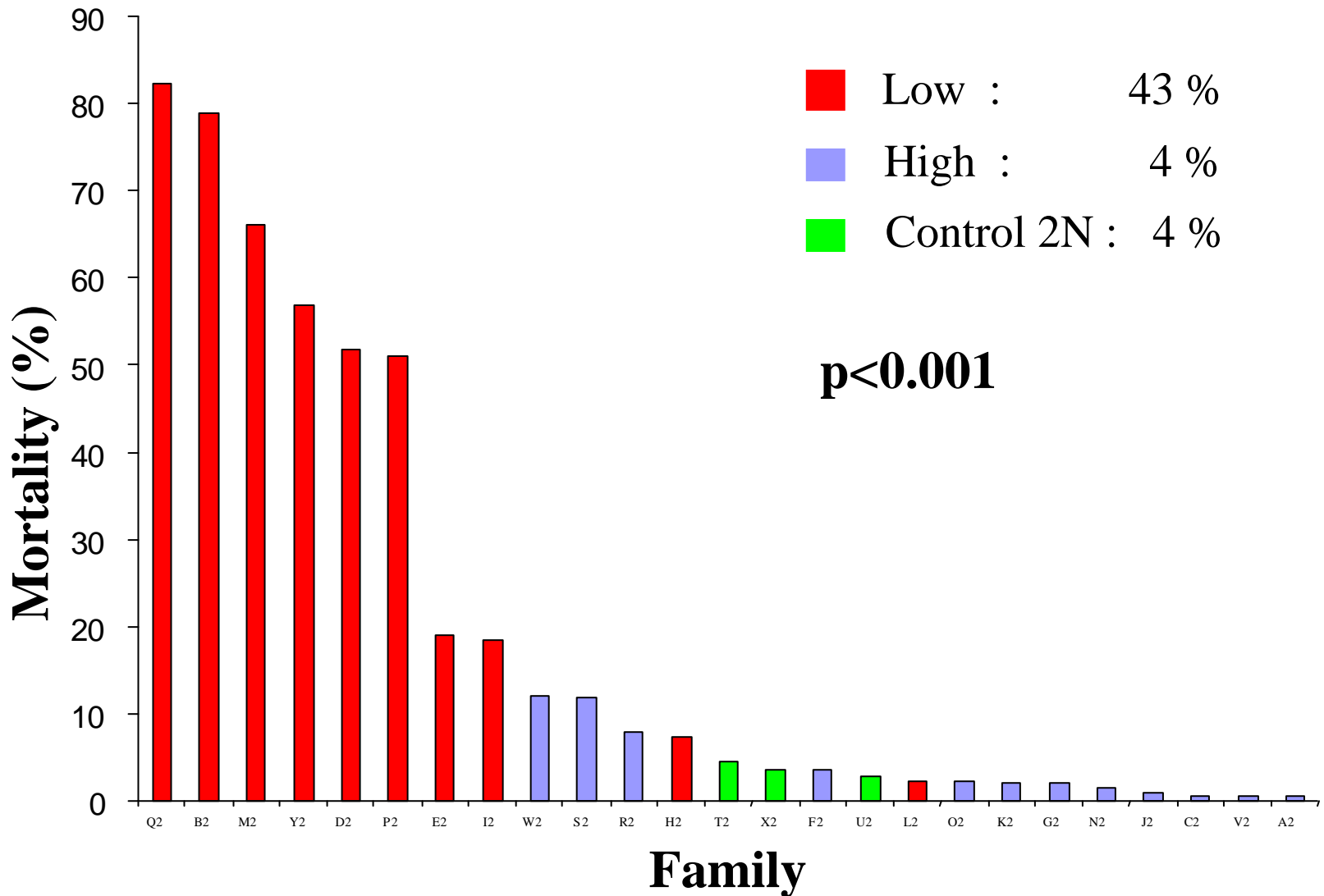
2N

Male	Family	4	7	14
	Family	F4-15 F4-16	F7-25 F7-26	F14-54 F14-55
4	F4-15	13	14	
	F4-16	15	16	
7	F7-25		17 18	
	F7-26		19 20	
14	F14-54			21 22
	F14-55			23 24

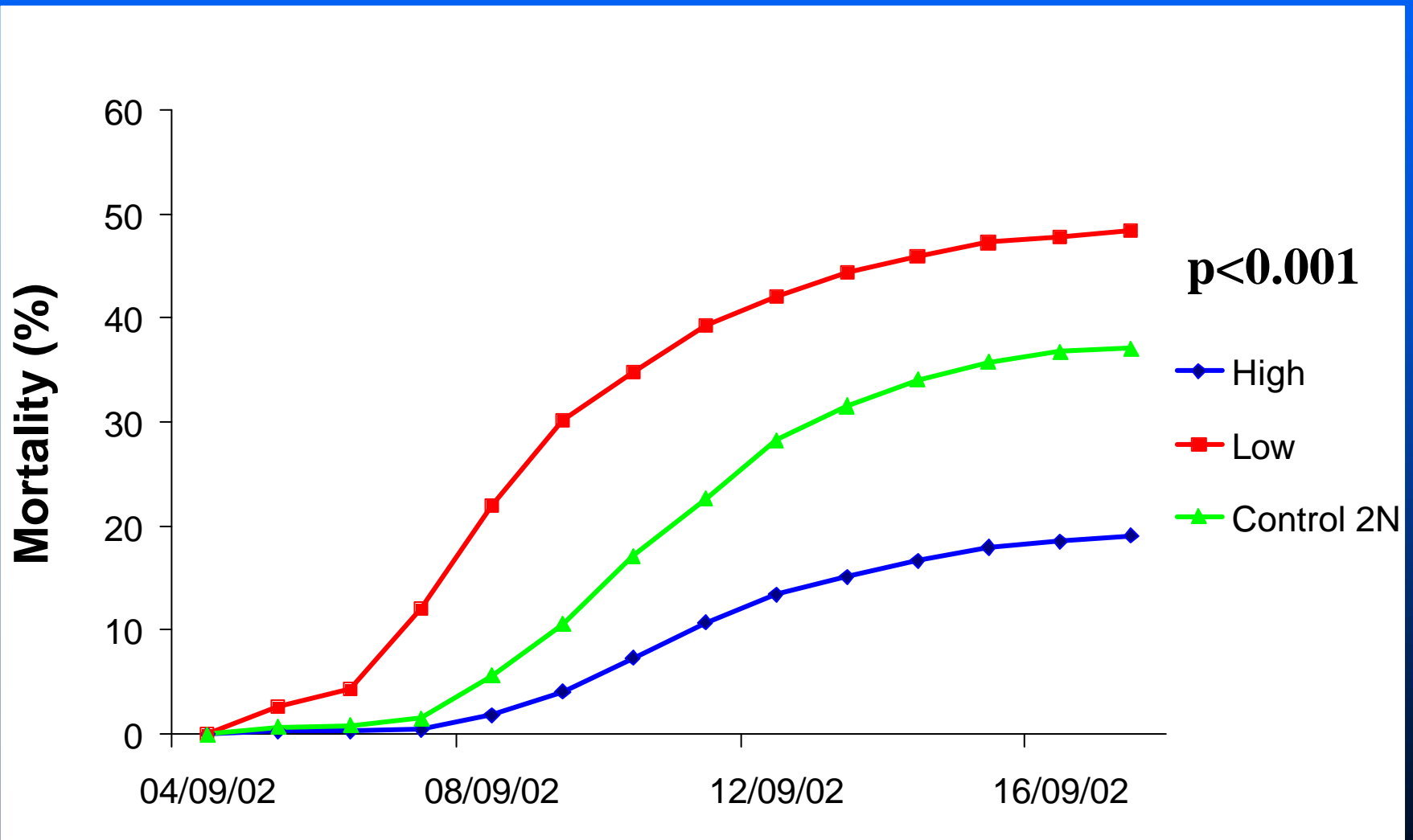
Male	Family	2	9	15
	Family	F2-5 F2-8	F9-35 F9-36	F15-57 F15-58
2	F2-5	1	2	
	F2-8	3	4	
9	F9-35		5 6	
	F9-36		7 8	
15	F15-57			9 10
	F15-58			11 12

G2 Inbred lines : mortality in the field

Site : Ronce (Marennes-Oléron Bay)



G2 inbred lines : mortality *in laboratory*



Conclusion :

- Differences of survival among half-sib families (G1)
- High response to selection and confirmation of the strong heritabilities for survival between the G1 and G2

Selective breeding programs could improve survival of juveniles oysters

- No negative effect on the growth

Perspectives :



- 1- To reconstitute the divergent selection to confirm the results of the second generation
- 2- Development of inbred lines for the families that showed high and low levels of survival
- 3- Cryopreservation of gametes for the selected families
- 4- Availability of selected families with high and low survival performances for the others disciplines of the framework « MOREST » (immunology, physiology, ecotoxicology...)

Specials thanks to :

- Hatchery team

Laboratoire de Génétique et Pathologie

- Nursery team

Laboratoire conchylicole des Pays de Loire

- Field teams

Laboratoire Conchylicole du Poitou Charentes

Laboratoire Conchylicole de Bretagne

Laboratoire Conchylicole de Normandie

- BIG BOSS TEAM

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