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ANEUPLOIDY AND ITS RELATIONSHIP WITH GROWTH IN DIFFERENT POPULATIONS OF THE PACIFIC OYSTER (CRASSOSTREA GIGAS, THUNBERG).

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Introduction

Chromosome number (2n = 20) and gross morphology are highly conserved in oysters **(Leit o et al. 1999).**

Polyploids (3n, 4n) can be produced by various techniques and are increasingly used in oyster aquaculture.

☞ **enhanced productivity**

Cytogenetic abnormalities, such as **aneuploidy**, are known to be common in bivalve populations

☞ **growth retardation**

Aneuploidy

2 different "types" of aneuploidy :

1. Chromosome number differs from the normal 2n= 20 in the whole animal, e.g. by accident during triploid production **(Wang *et al.* 1999).**

2. Chromosome number differs from the normal 2n= 20 in some cells of the animal, leading to mosaics.

☞ Reversion of triploid oysters **(Allen et al. 1999)**

☞ Growth retardation in diploid oysters **(Thiriot-Quiévreux *et al.*, 1988, 1992 ; Zouros *et al.* 1996)**

Material & Methods

♦ *Chromosome scoring*:

- Live animals incubated in sea water + 0.005% colchicine.
- Slides made following the air drying technique (Thiriot-Quiévreux and Ayraud 1982).
- Giemsa staining.
- Chromosome counts on intact and well-spread metaphases.

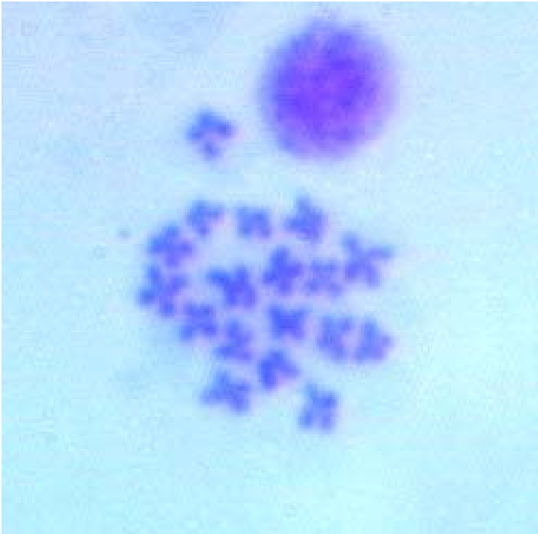
☞ 30 metaphases scored per individual

♦ *Populations or families studied:*

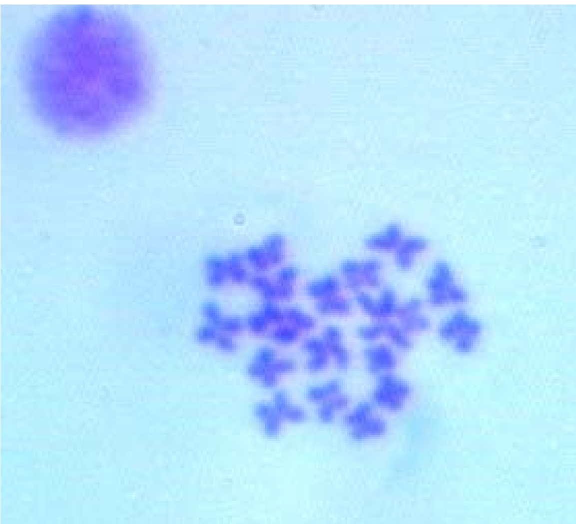
- 8 previously published data sets
- 15 new data sets

☞ classified as "slow-growing" or "fast-growing" or individually monitored.

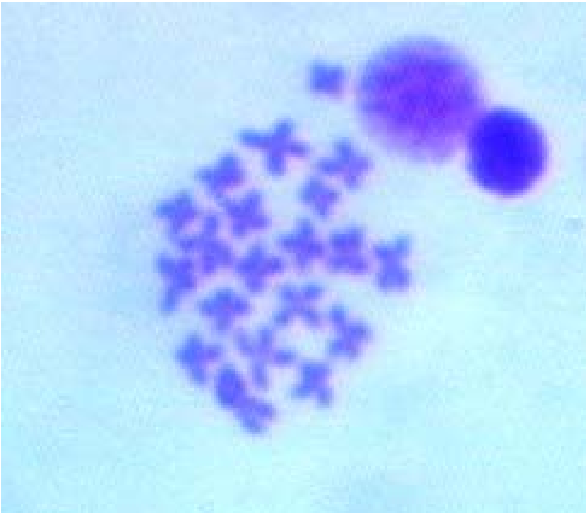
2n = 17



2n = 18



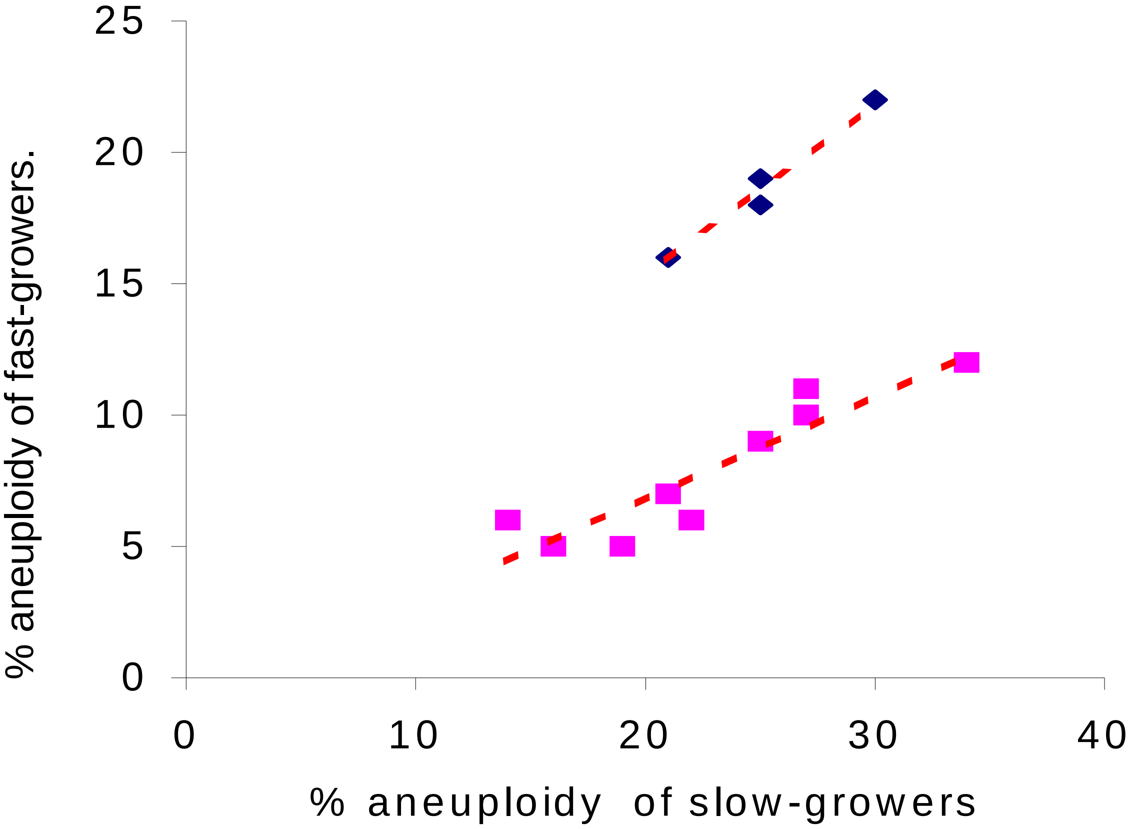
2n = 19



2n = 20

Are "small" oysters more aneuploid ?

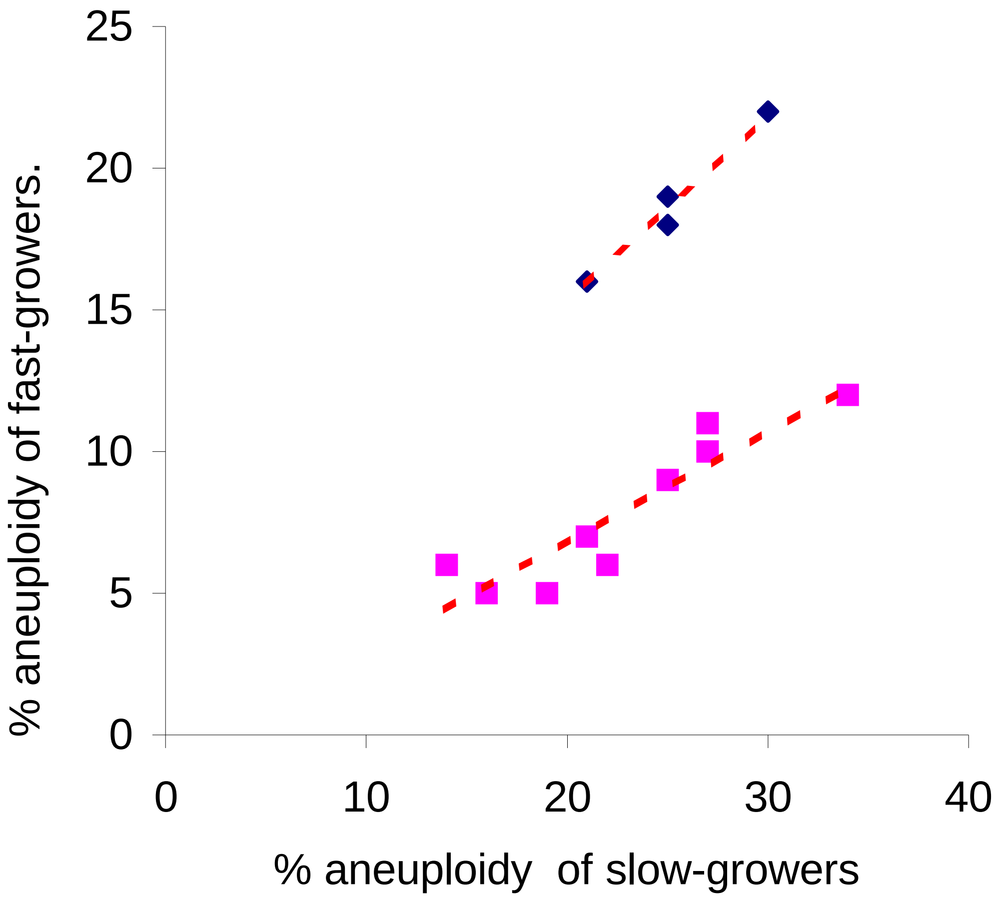
Comparison in 13 populations



☞ In all the populations studied, "slow-growing" oysters are more aneuploid than "fast-growing" oysters.

Are small oysters more aneuploid ?

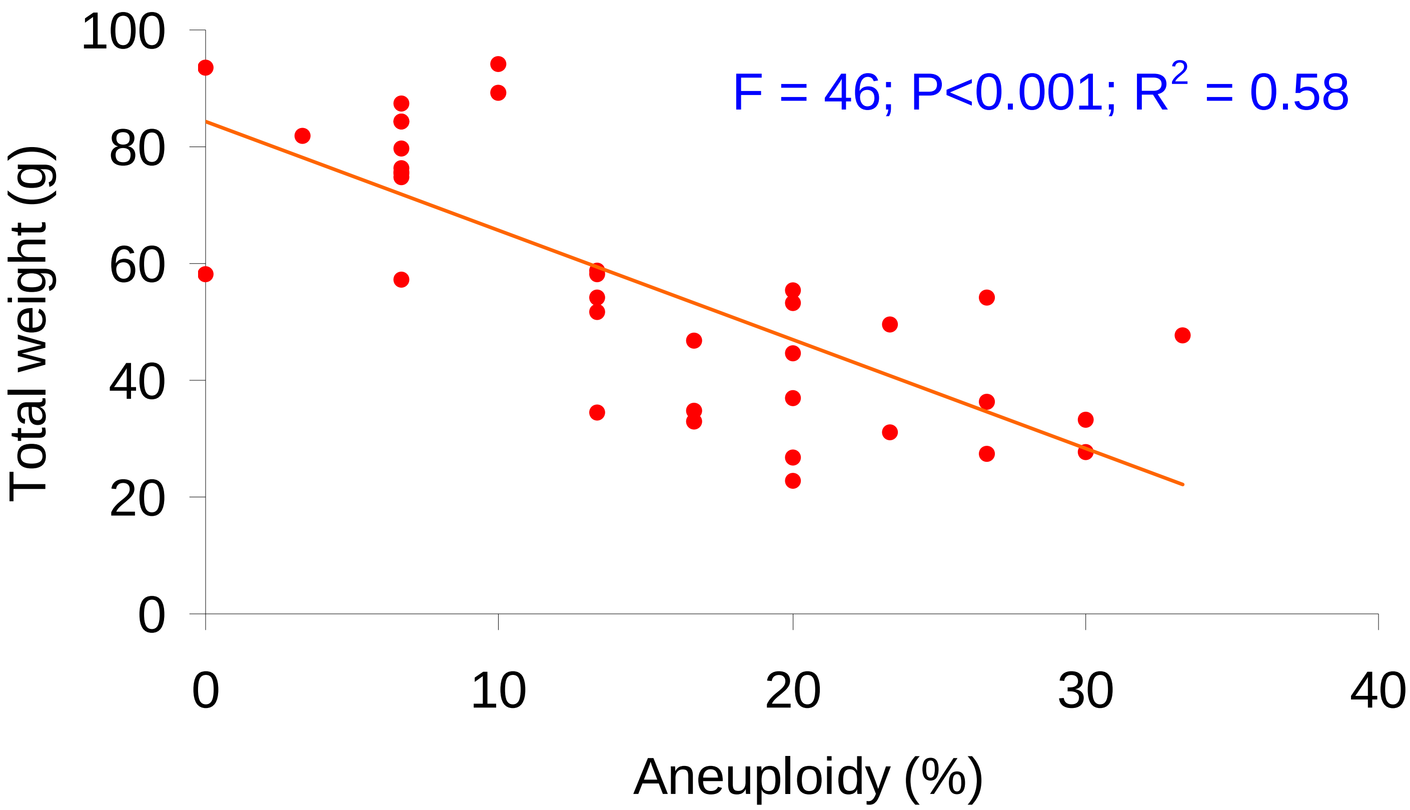
Comparison in 13 populations



☞ The aneuploidy of "fast-growing" oysters relative to "slow-growers" varies between populations.

Are small oysters always more aneuploid ?

Individual growth/aneuploidy relationship (36 ind.)



☞ Individual growth is highly correlated with individual aneuploidy

Does aneuploidy vary between families ?

Comparison between 6 FS families

Family	First sample: Aneuploidy (%)		First sample: Mean family weight (g)		Second sample: Aneuploidy (%)		Second sample: Individual weight (g)
1	26	+	0.590	-	25	+	0.983
2	15		0.751		16		0.983
3	17		0.906		15		0.983
4	14		1.012		14		0.983
5	13		1.222		11		0.983
6	13	-	1.488	+	14	-	0.983

(10 individuals/sample/family)

☞ The slowest-growing family (1) shows the highest aneuploidy ($p < 0.001$), even when the individuals studied have the same weight.

Is aneuploidy "heritable" ?

- Difficulties due to the lack of a non-destructive method for scoring aneuploidy

Parental aneuploidy (%)		Offspring aneuploidy (%)	
male	female	Sample 1: **Mean family weight**	Sample 2: **Common mean individual weight**
20	10	8	9
20	23	16	18
7	23	13	13
7	10	15	14

(10 individuals/sample/family)

☞ Significant differences ($p = 0.017$) are observed between progenies but further experiments, based on non-destructive methods, are needed.

What are the causes of aneuploidy ?

Environmental causes

- Pollution **(Dixon, 1982)**
- Viral disease **(Maroun et al., 1986)**

Genetic basis

- Chromosome number instability ?

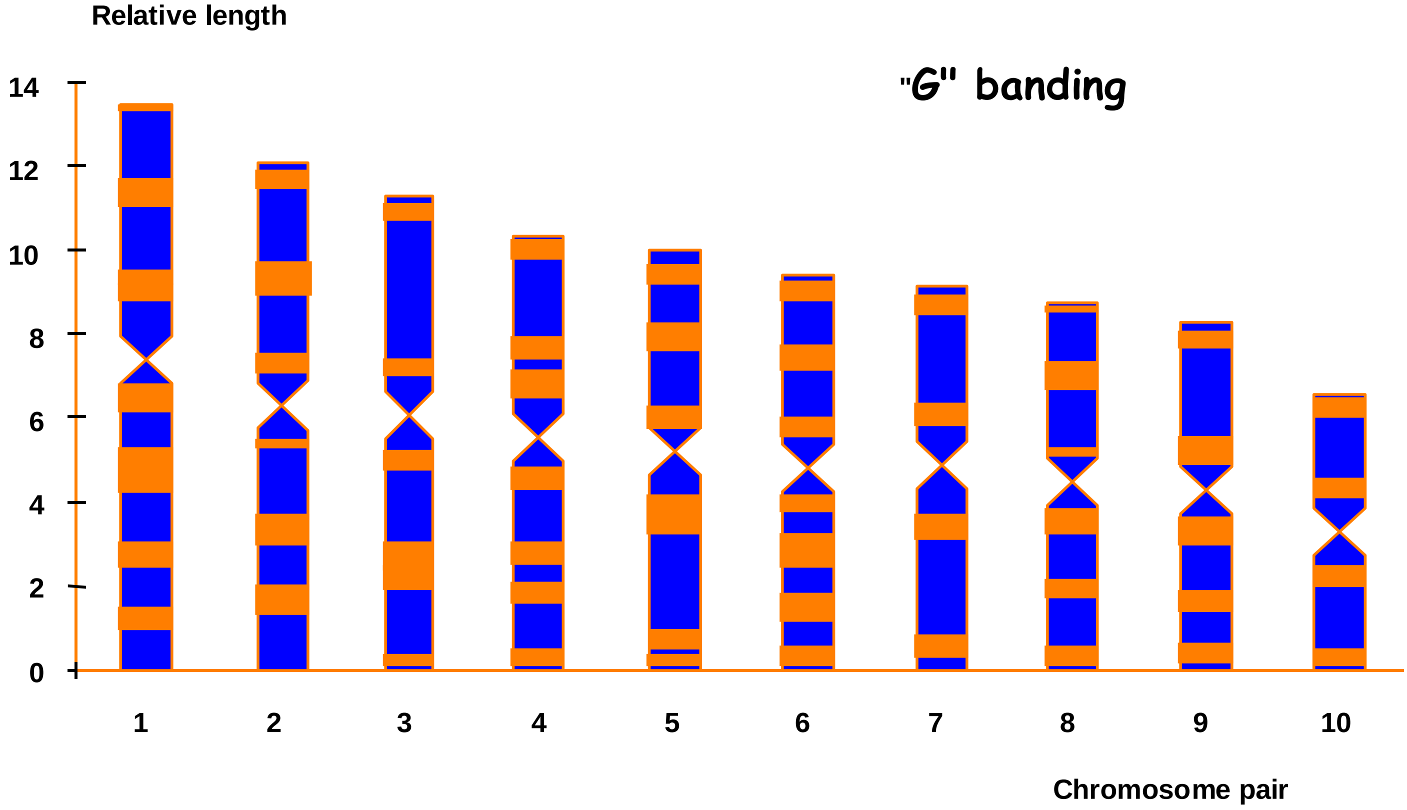
How can the negative growth-aneuploidy relationship be explained ?

Zouros et al. (1996)

- Introduction of a pseudo-dominance of deleterious genes
- Alteration of the heterozygotic index, induced by aneuploidy
- Low growth rate due to the absence of the same genetic function in a large number of cells
- Size-dependant susceptibility to the causal factors

Future research

- Cell culture in oysters ?
- Identification of missing chromosomes
  (Leit o et al., 1999)



Conclusions

☞ Aneuploidy is a common phenomenon in oysters. Its negative relationship with growth is undeniable.

☞ Further research is needed to determine the environmental/genetic causes of aneuploidy.

☞ Because of its relationship with growth, it should be taken into account in selective breeding programs.

☞ As chromosome number instability has been reported to be a problem in triploid oysters, the relationship between these two phenomena could be investigated.