



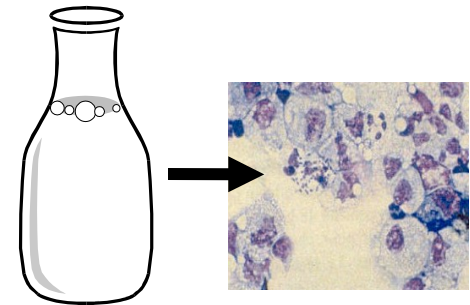
BREEDING FOR MASTITIS RESISTANCE: Procedure and consequences of SCC- based selection in sheep

**R. Rupp¹, D. Bergonier², S. Dion¹, M.C. Hygonenq², M.R.
Aurel³, C. Robert-Granié¹, G. Foucras²**

1INRA U631, F-31326 Castanet-Tolosan
2INRA-ENVT UMR1225, F-31076 Toulouse
3INRA UE321, F-12250 Roquefort

Introduction

- **Breeding for mastitis resistance = a strategy to control the disease**
 - Prophylaxis and drugs of limited efficacy
 - Selection on Milk Production traits deteriorates mastitis resistance
- **Selection based on milk Somatic Cell Counts**
 - Predictor of udder infections
 - Early studies show genetic variability
 - Possibility of large scale recording





SCC-BASED SELECTION IN DAIRY SHEEP

How it is implemented

**What consequences are expected
(divergent selection experiment)**

Recording scheme for SCC

- Recording for **Somatic Cell Counts** in French dairy sheep

- From 1999 onwards
- Flocks in the official milk recording system
- Simplified method of sampling :
 - 1-4 records/lactation at morning milking
- All individuals in 1st and 2nd lactation

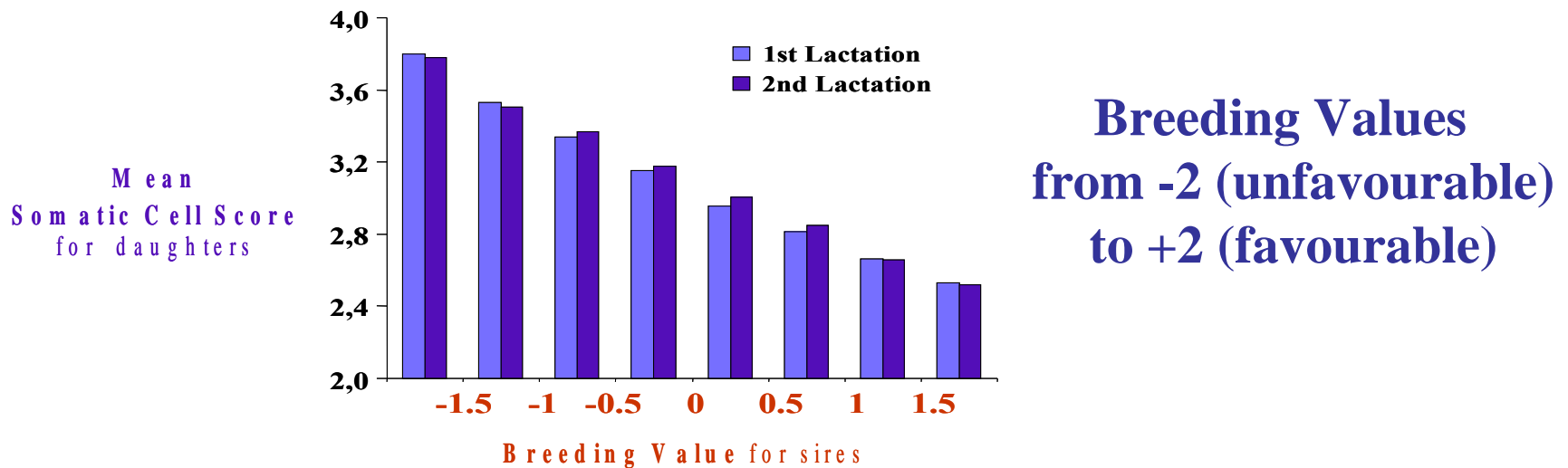


**Ovine
National
Data
Base**

=> About 2 millions SCC records

Genetic Evaluation

- **Genetic parameters** : $h^2=0.13$ and $rg_{L1-L2}=0.9$ and $r=0.3$
- **Data** : $\approx 700\,000$ lactations of the Lacaune breed (>1999 ; ≥ 1 SCC)
- **Model** : Animal-Repeatability for lactation average in L1 & L2



• **Selection index:** $ISOL = I_{\text{Production}} + \frac{1}{2} I_{\text{SCC}} + \frac{1}{2} I_{\text{UdderType}}$



SCC-BASED SELECTION IN DAIRY SHEEP

How it is implemented

**What consequences are expected
(divergent selection experiment)**

Divergent selection experiment

•Objective

- Evaluate response to SCC based selection
- Better understand mechanisms underlying resistance to mastitis

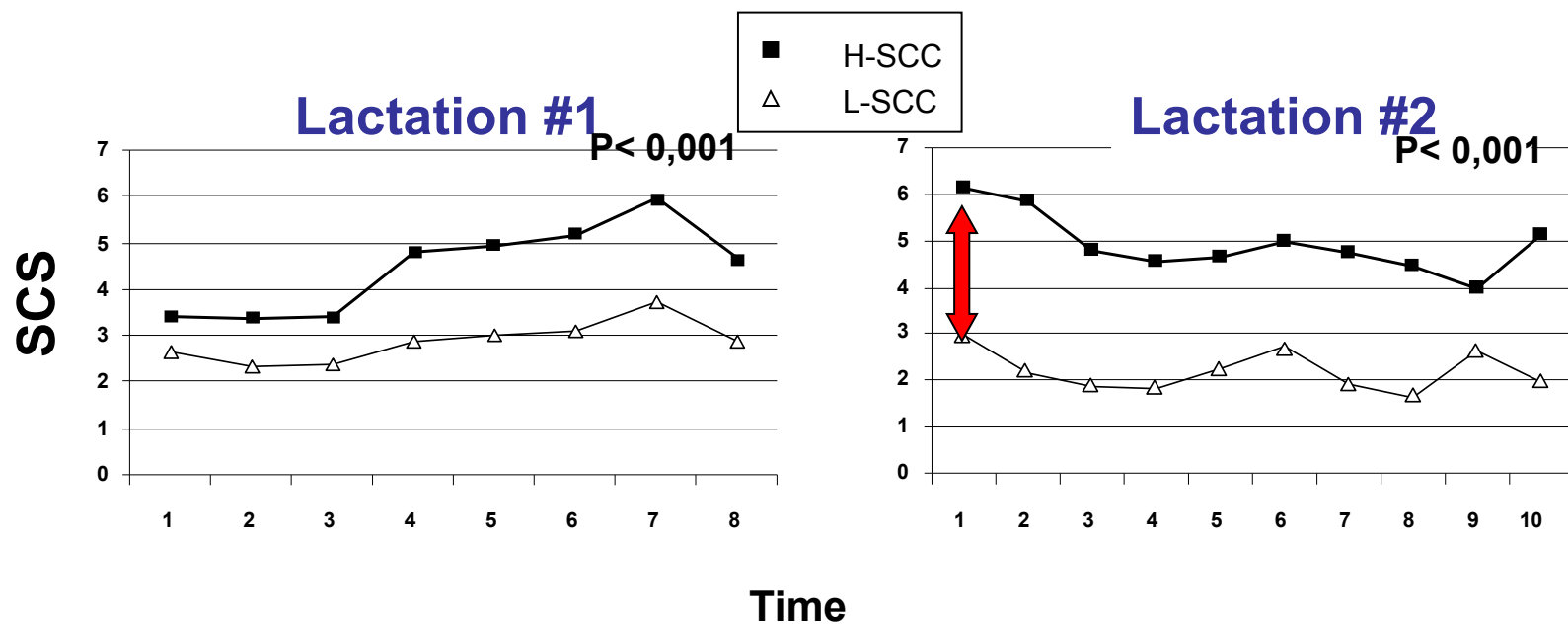
•Design

Divergent selection on SCC in Lacaune dairy sheep breed

- Rams from the population with extreme SCC EBVs
- Daughters housed in the INRA experimental farm of La Fage
- Survey during 3 lactations: clinical examination, milk bacteriological analyses, SCC measures, ...

Divergent selection experiment

- Results: SCC in 82 High and Low SCC ewes



⇒ Large difference in SCC: $3\sigma_g \approx 30$ years of selection

Divergent selection experiment

- **Results: Clinical mastitis in High and Low SCC ewes**

Genetic line	High-SCC (n=41)	Low-SCC (n=37)
Clinical mastitis	5	0
Abscess (%) (ewes)	17.1 (13)	0.7 (1)

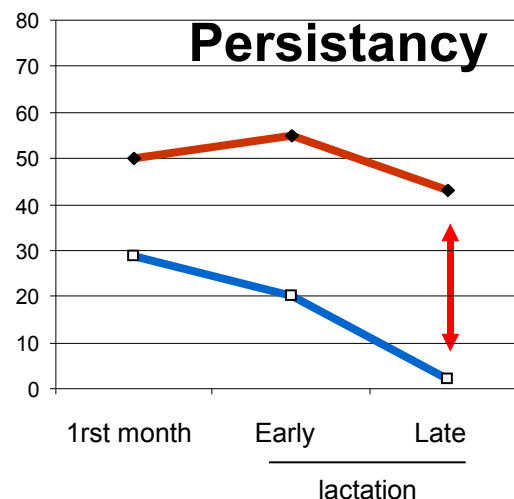
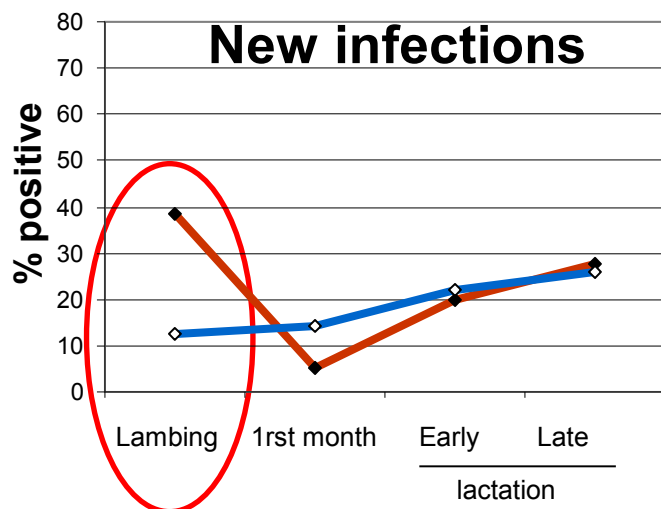
⇒ **Lower clinical mastitis frequency in Low SCC line ewes**

Divergent selection experiment

- **Results: subclinical mastitis**

31% of milk samples are bacteriologically positive

Main agents: Coagulase-Negative Staphylococci



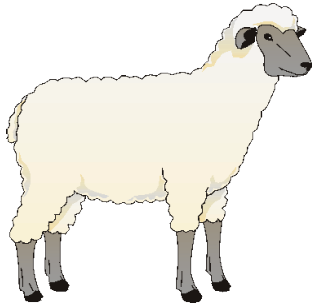
High SCC line
Low SCC line

⇒ Low SCC ewes : lower susceptibility at lambing
Lower persistency of infections

Divergent selection experiment

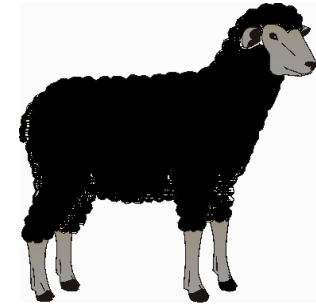
- **Results: experimental infections**

7 Low-SCC ewes



Divergent lines
(INRA experimental farm)

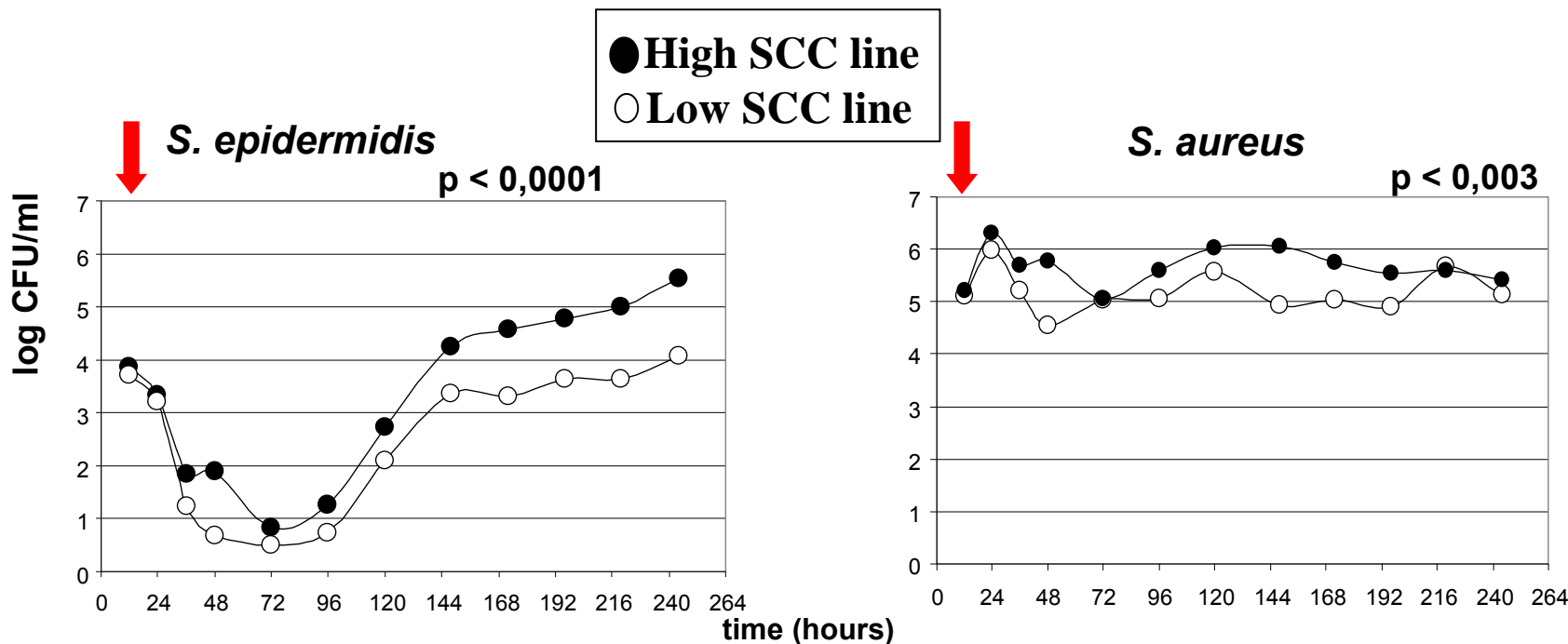
7 High-SCC ewes



Experimental challenge
(Veterinary School, Toulouse)
 10^3 CFU/udder half
S.epidermidis / *S.aureus*

Divergent selection experiment

•Results: experimental infections



⇒ Bacteria titre is significantly lower in Low SCC ewes

Summary

Primary results from a divergent selection experiment gave strong evidence that EBV SCC-based selection may help to improve resistance to clinical and subclinical mastitis



Low SCC animals showed a lower incidence of clinical mastitis, a lower prevalence of mammary abscesses and subclinical infections - especially at parturition -, a better ability to recover from infection, and lower bacteria titer in experimentally challenged animals

Acknowledgment

- Fabien Carriere, Jean-Marie Menras, Francois Pailler and David Portes from the INRA experimental unit La Fage
- Grants:
Midi Pyrenees Region, GENANIMAL 2003, and ACI microbiologie 2003 projects.