Feed-a-Gene

Adapting the feed, the animal and the feeding techniques to improve the efficiency and sustainability of monogastric livestock production systems

EAAP 2018, Dubrovnik, Croatia

Effect of heat stress on fecal microbiota composition in swine

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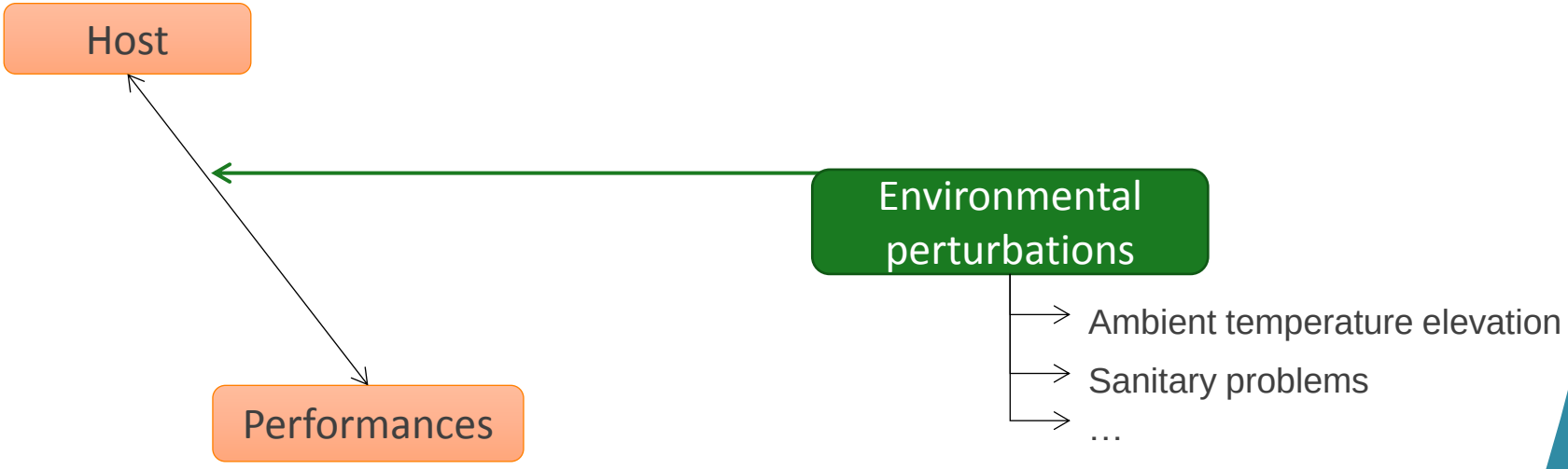
Context and objectives

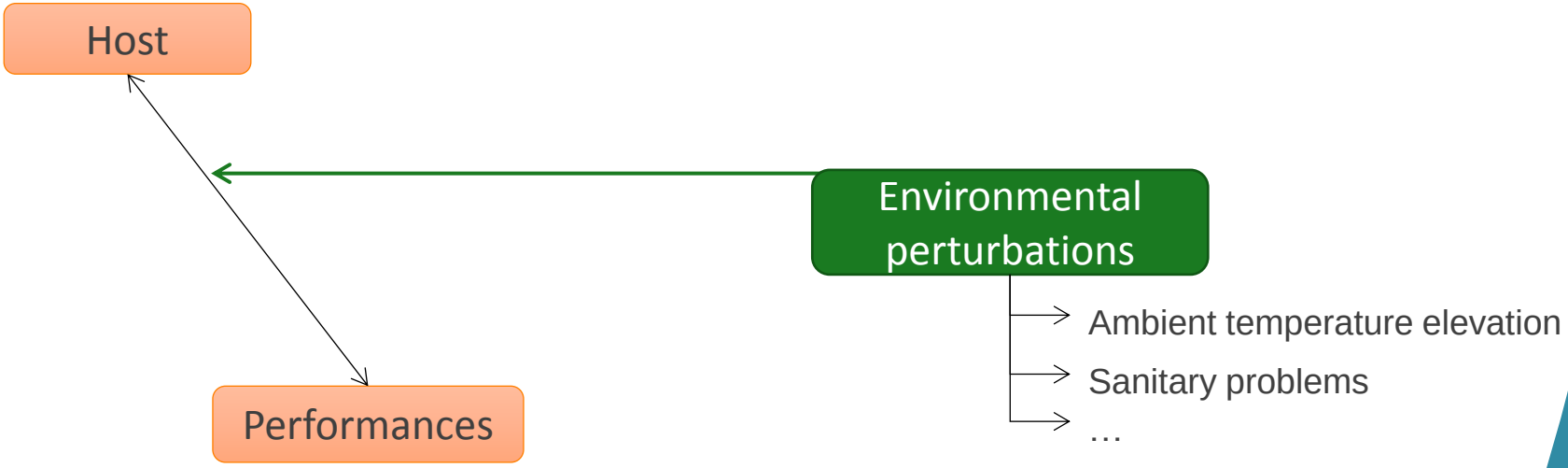
Context



Context and objectives

Context

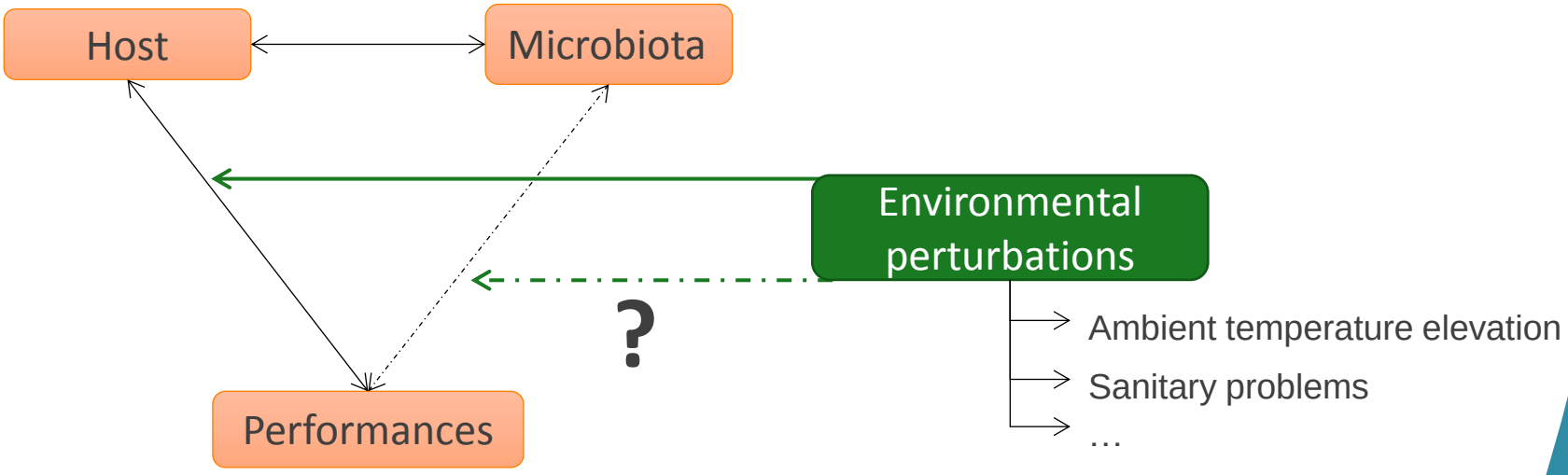
- Heat stress (HS) : main concern for livestock production in many countries
- New methods to improve performances



Context and objectives

Context

- Potential role of microbiota in pig metabolism
- Would help the host for better coping with environmental perturbations



Context and objectives

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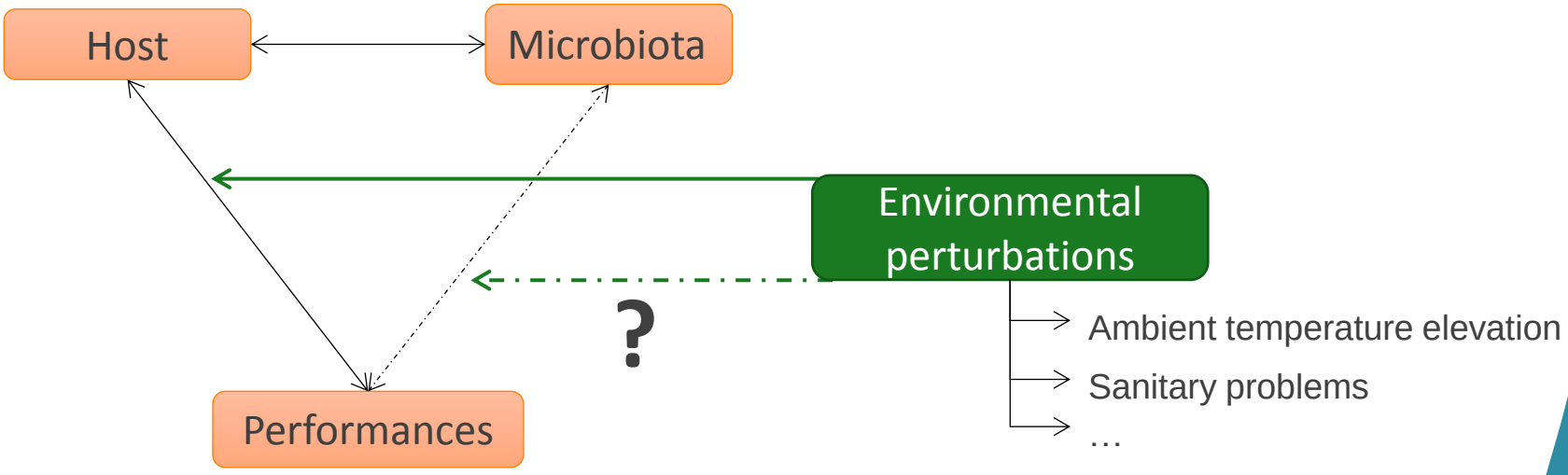
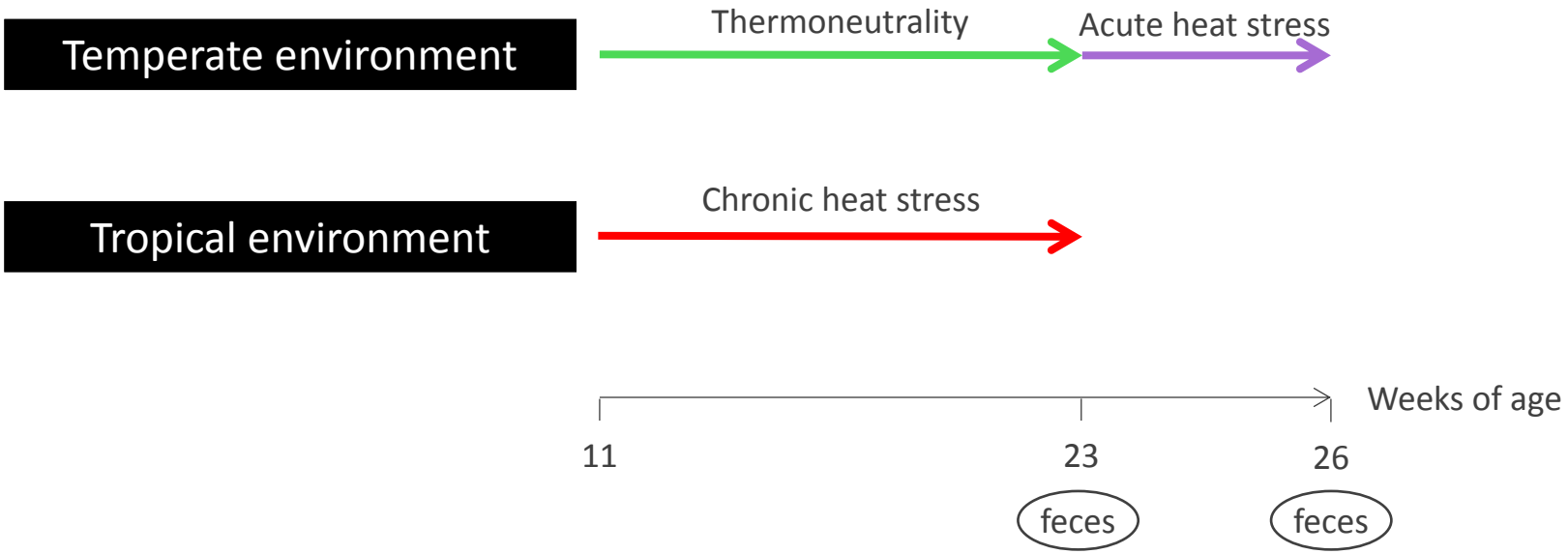


Objective

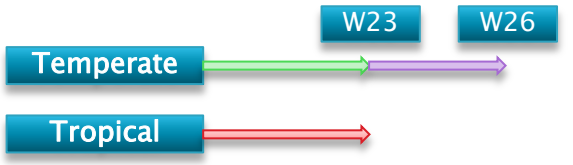
- **What is the impact of climate and heat stress on pig gut microbiota?**

Experimental design

- 1,200 pigs raised under temperate or tropical climate
- Cross-bred Large White x Créole



- Fecal samples obtained at 23 wk (chronic HS n=600, thermoneutral n=600) and at 26 wk of age (acute HS n=600)
- Microbiota analysis : Illumina MiSeq sequencing → Operational Taxonomic Units (OTU)



Experimental design

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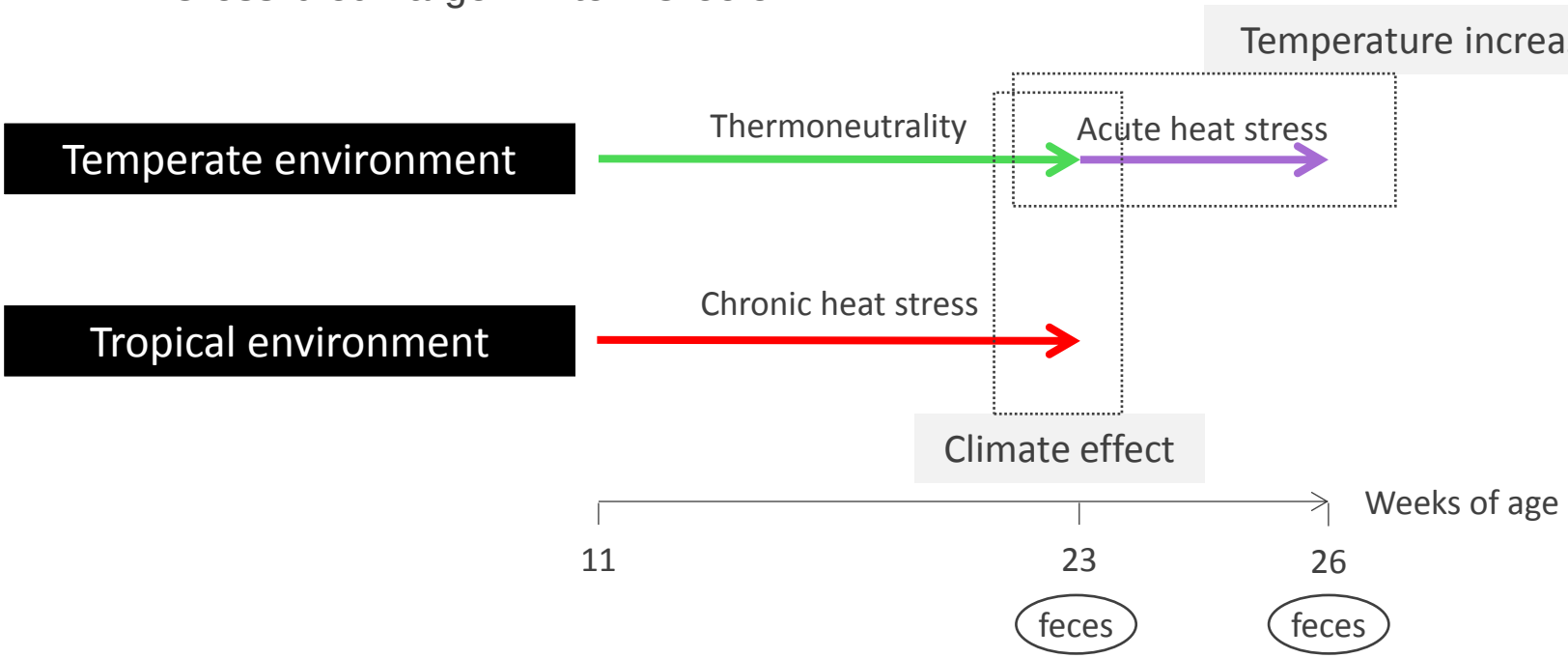

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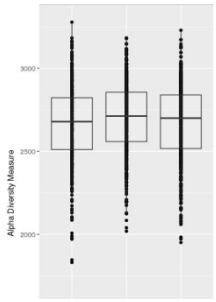
Statistical pipeline

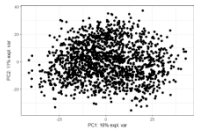
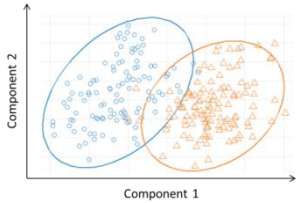
Analyses based on 1,688 OTUs

At least 7,000 sequences per sample

1,688 OTUs

1,607 samples — OTU table

- diversity → 

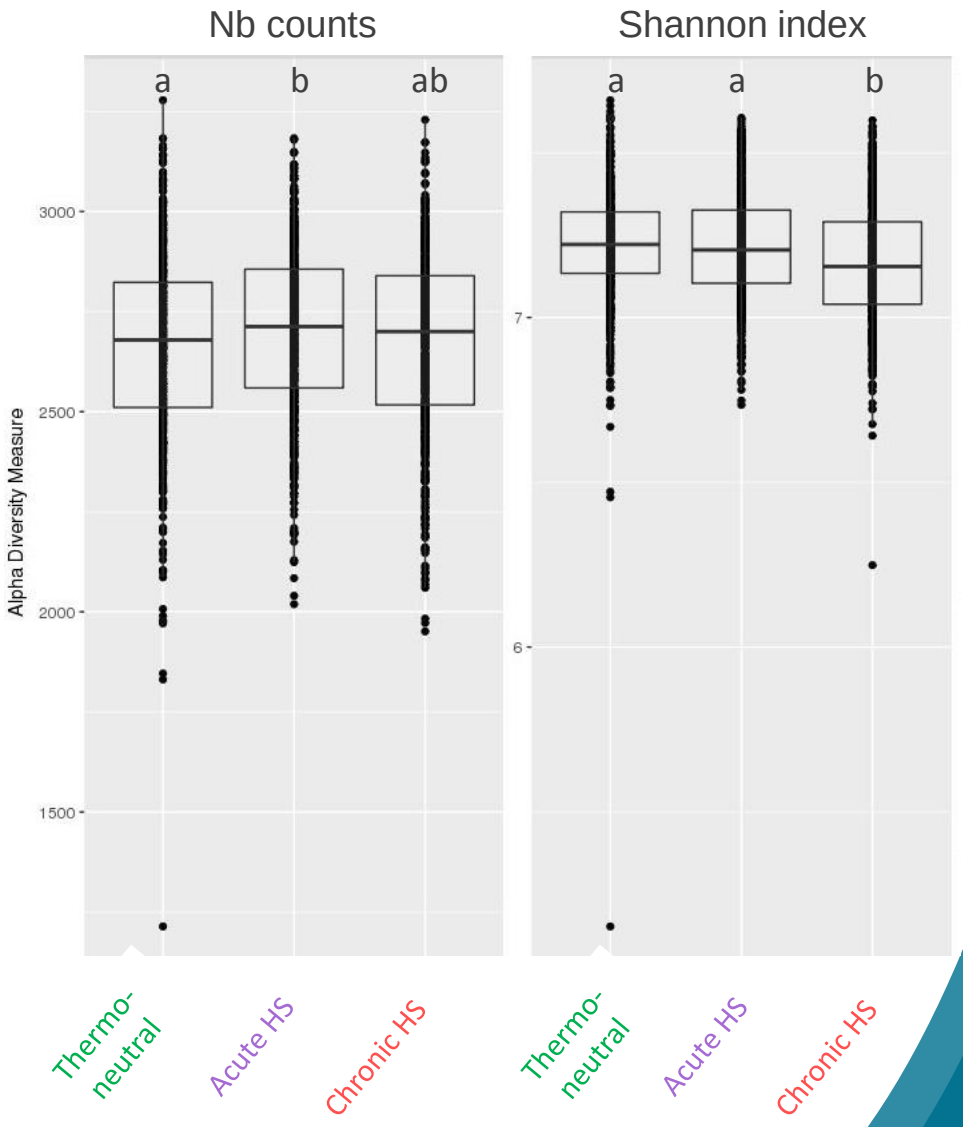
  - Unsupervised analysis
- PCA → 
  - Unsupervised analysis
- sPLS-DA → 

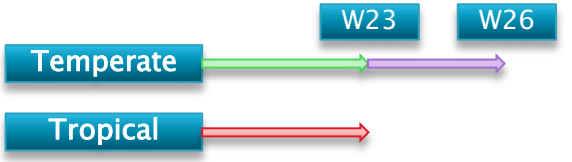
  - Supervised analysis

W23 W26
Temperate
Tropical

Results
Diversity

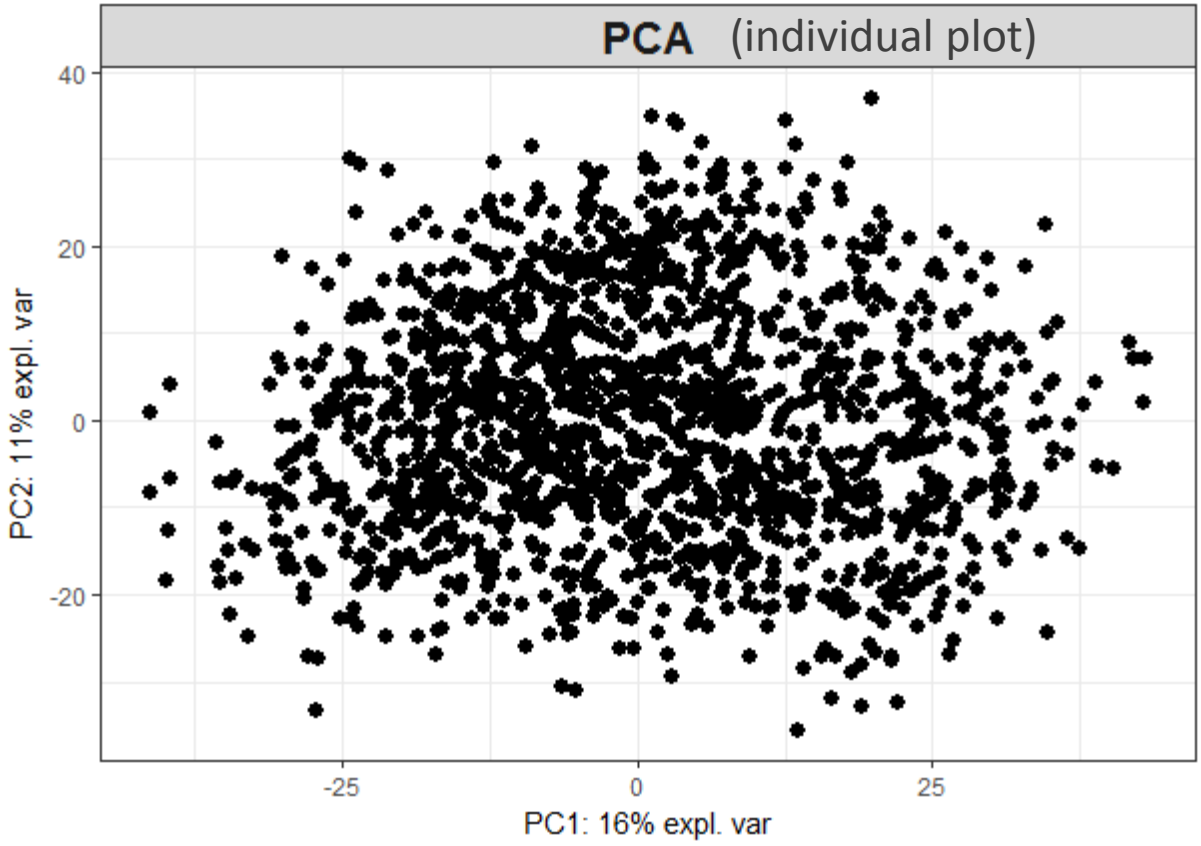
➔ No clear diversity difference between the environments

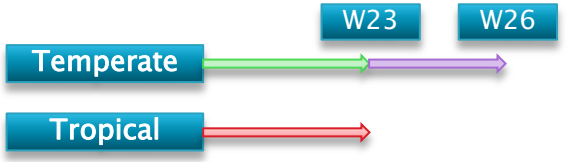




Results

Principal Component Analysis

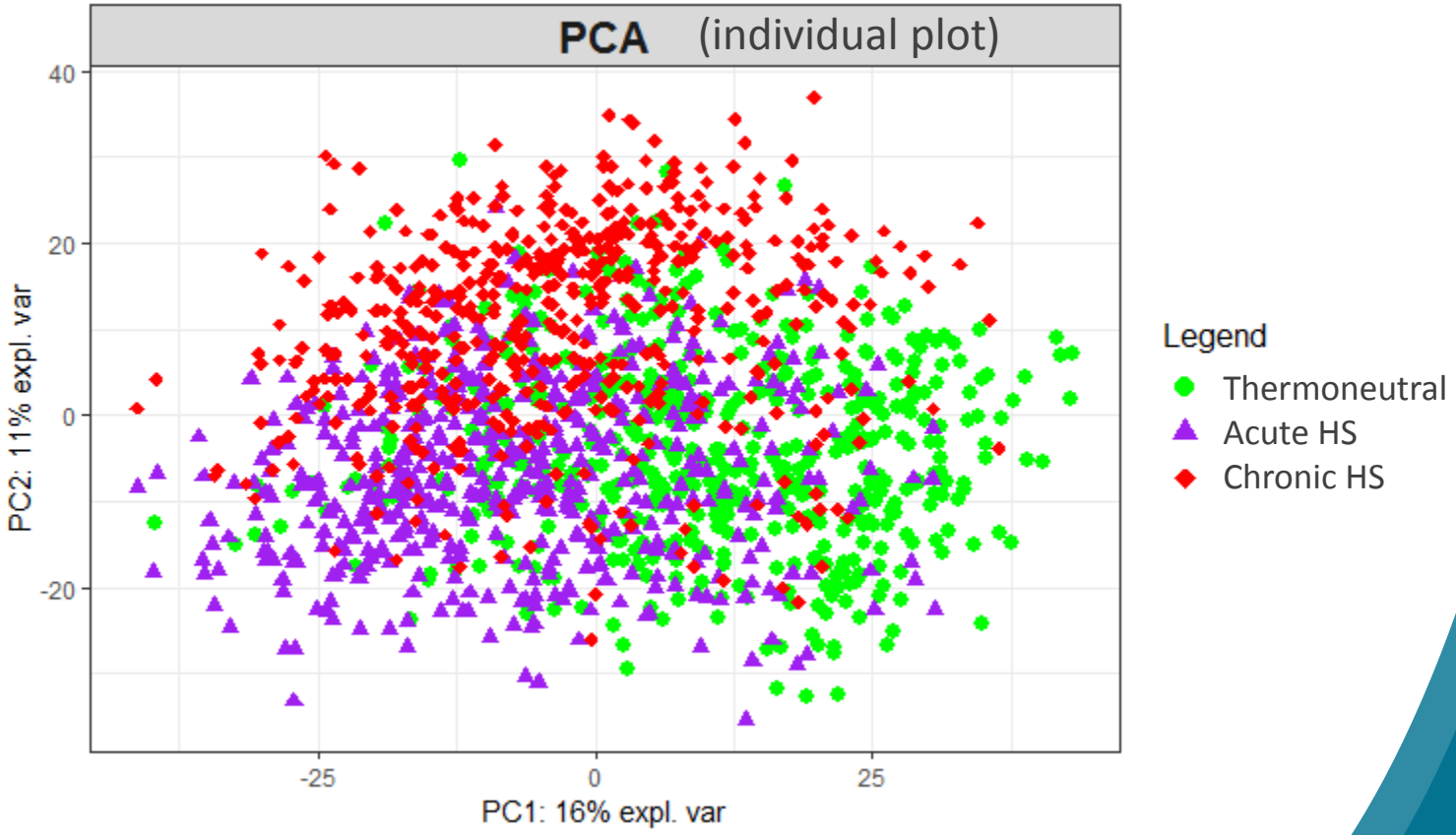


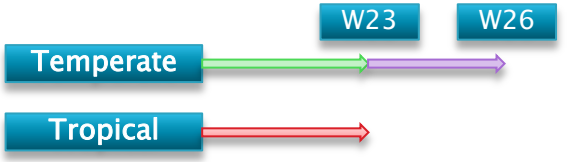


Results

Principal Component Analysis

➔ Groups according to the environment



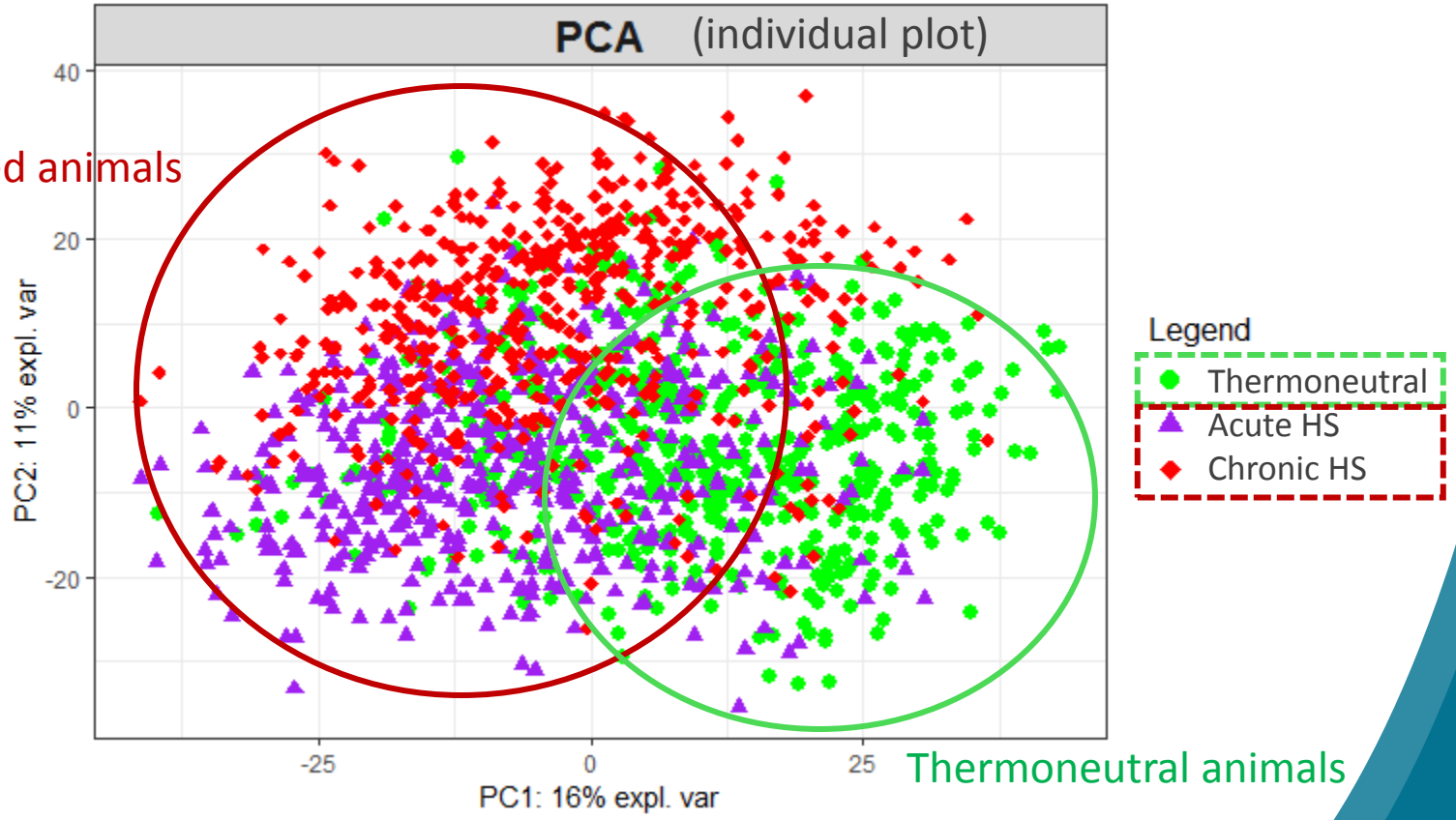


Results

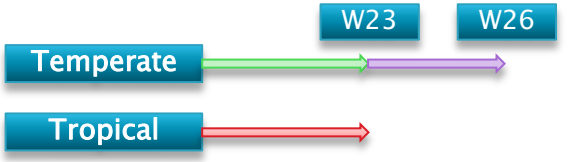
Principal Component Analysis

1st component: temperature effect

Heat stressed animals



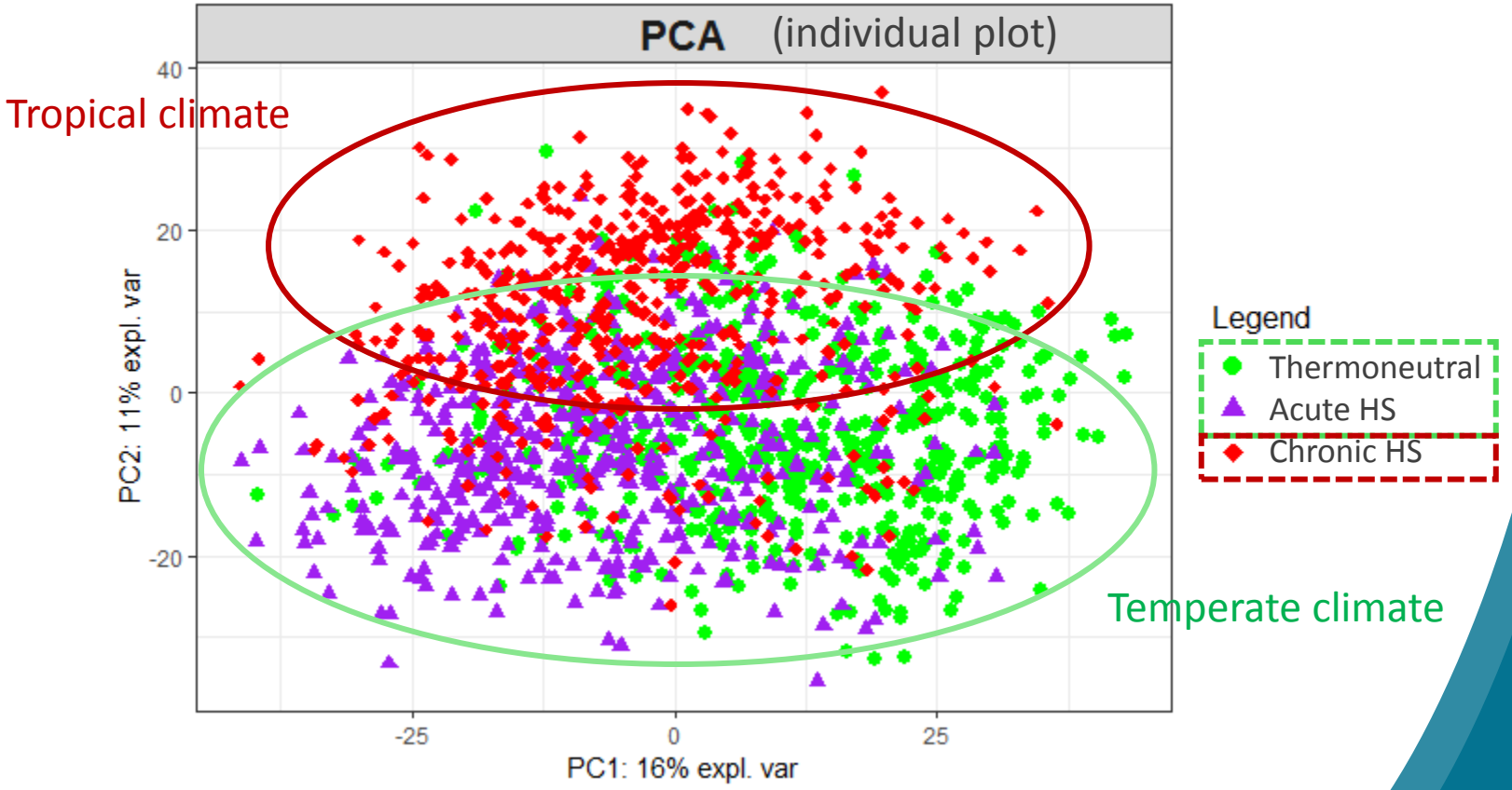
Thermoneutral animals

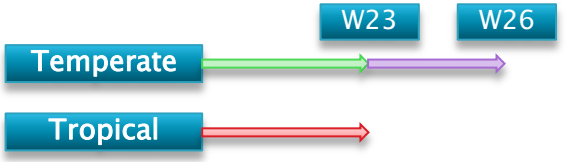


Results

Principal Component Analysis

2nd component: climate effect

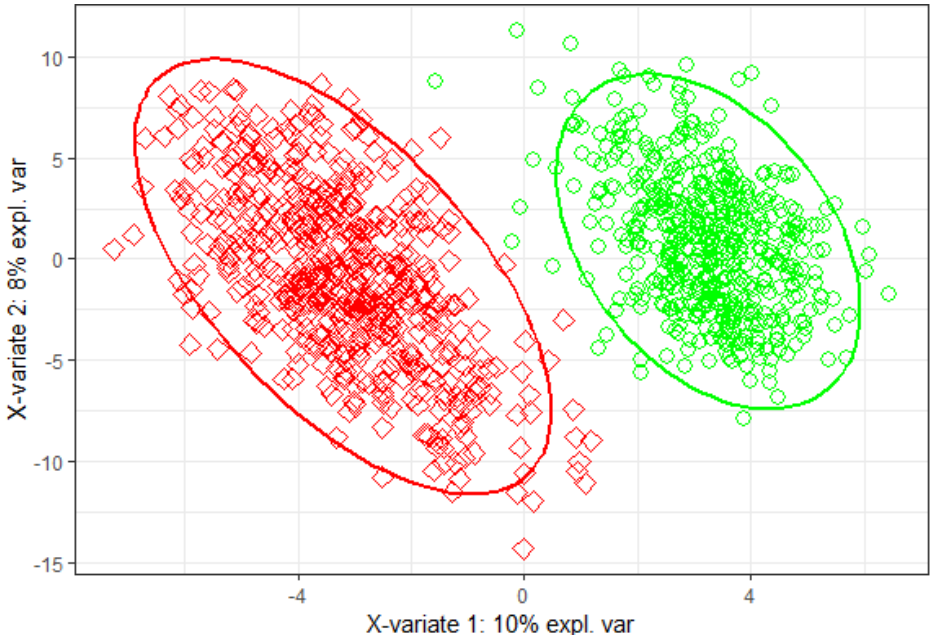




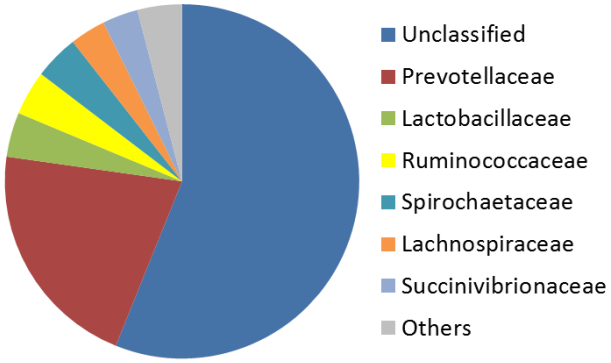
Results

Sparse Partial Least Square Discriminant Analysis

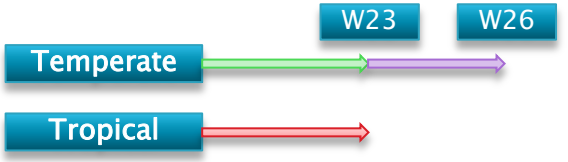
Thermoneutral vs chronic HS



Thermoneutral vs chronic HS highly discriminated using microbial information



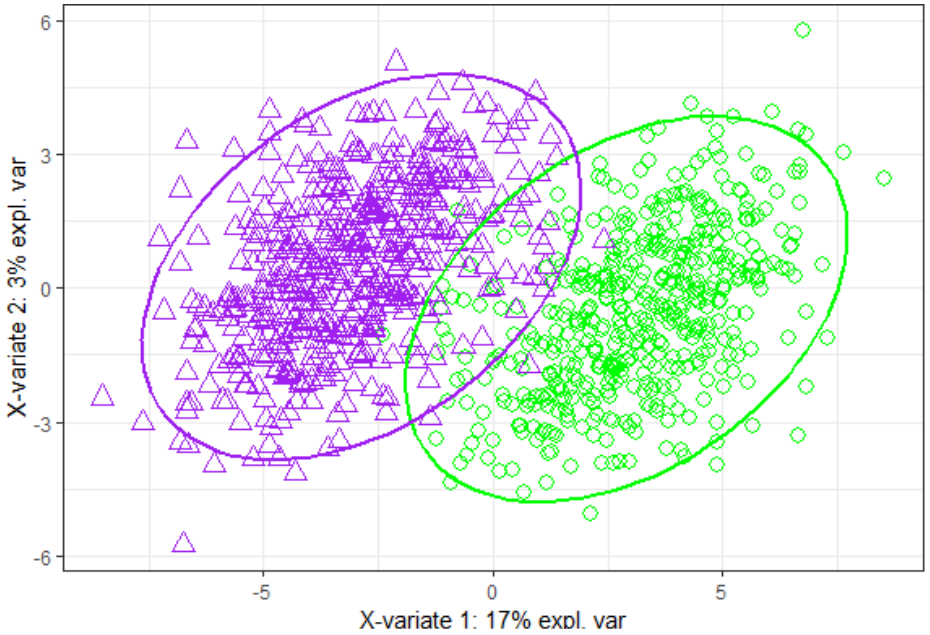
	Nb OTUs	Cumulative BER
1st component	36	1.7%
1st + 2nd components	36 + 89	0.2%



Results

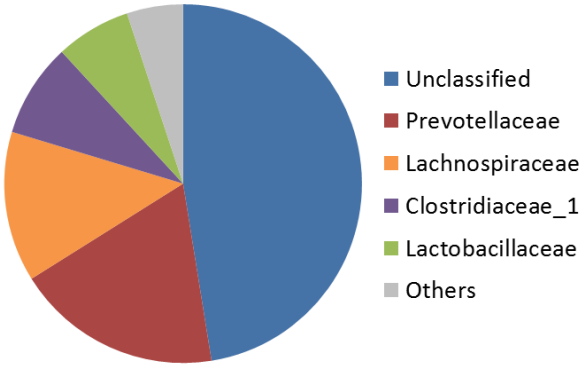
Sparse Partial Least Square Discriminant Analysis

Thermoneutral vs acute HS

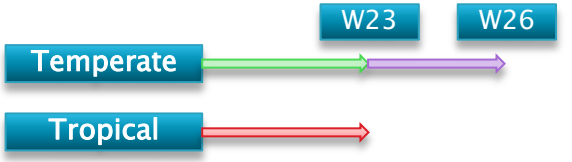


Legend
- Thermoneutral
- Acute HS

Thermoneutral vs acute HS well discriminated using microbial information



	Nb OTUs	Cumulative BER
1st component	32	9.3%
1st + 2nd components	32 + 30	7.1%

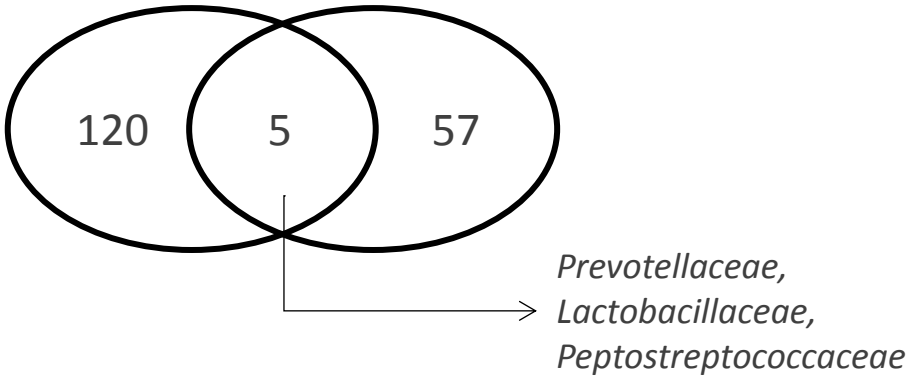


Results

Sparse Partial Least Square Discriminant Analysis

Thermoneutral vs chronic HS

Thermoneutral vs acute HS



- **Only 5 biomarkers of the « temperature increase » in common**

➔ 2 different stresses:

only short term temperature increase
vs
tropical environment (temperature, humidity…)

Conclusions

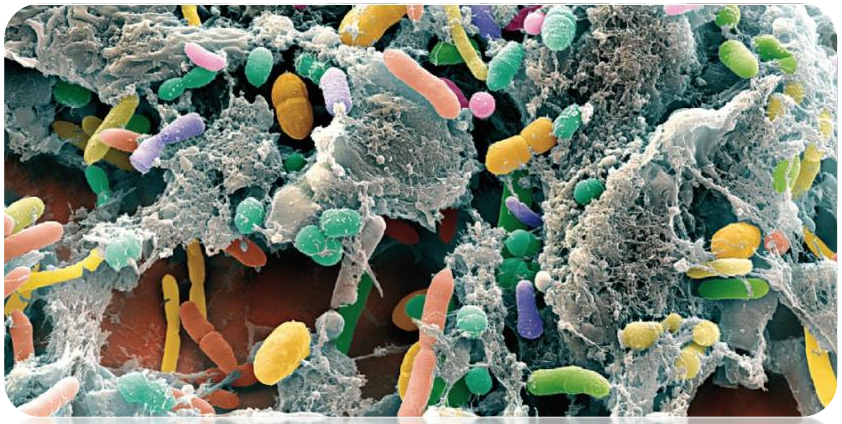
Microbiota information can be used to discriminate with accuracy:
- → Pigs raised under different climate environments
- → Pigs exposed to a heat stress

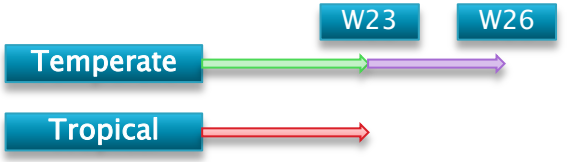
Microbiota composition can be used as biomarker of heat stress exposition in our experimentation

?

Use of microbiota as a biomarker of the pig adaptation to heat stress?

Thank you for your attention

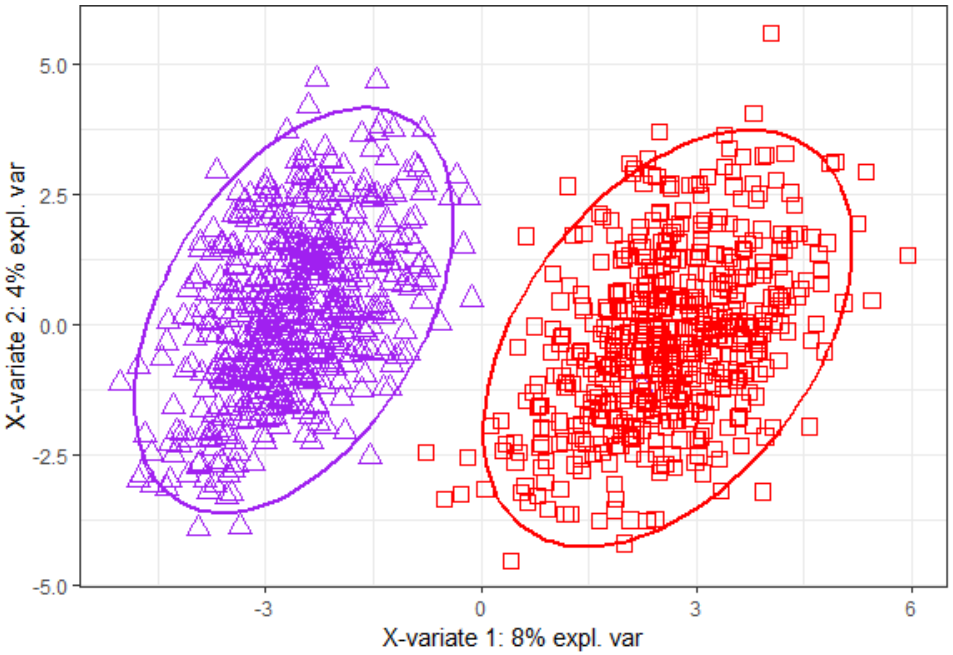




Results

Sparse Partial Least Square Discriminant Analysis

Acute HS vs chronic HS



Climates highly discriminated

	Nb OTUs	Cumulative BER
1st component	16	0.5%
1st + 2nd components	16 + 19	0.2%

Experimental design

Temperature per batch under temperate climate