

Physicochemical characterization of rice bran from different locations by classical and omics analysis

Valorization of Rice Bran Mini-symposium

Friday December 4th

MILLENA BARROS SANTOS

Project participants: Nathalie Barouh; Erwann Durand; Bruno Baréa; Mélina Robert; Valérie Micard; Valérie Lullien-Pellerin; Pierre Villeneuve; Luiz Cameron; Elizabeth Ryan; **Mariana Ferreira; Claire Bourlieu-Lacanal**



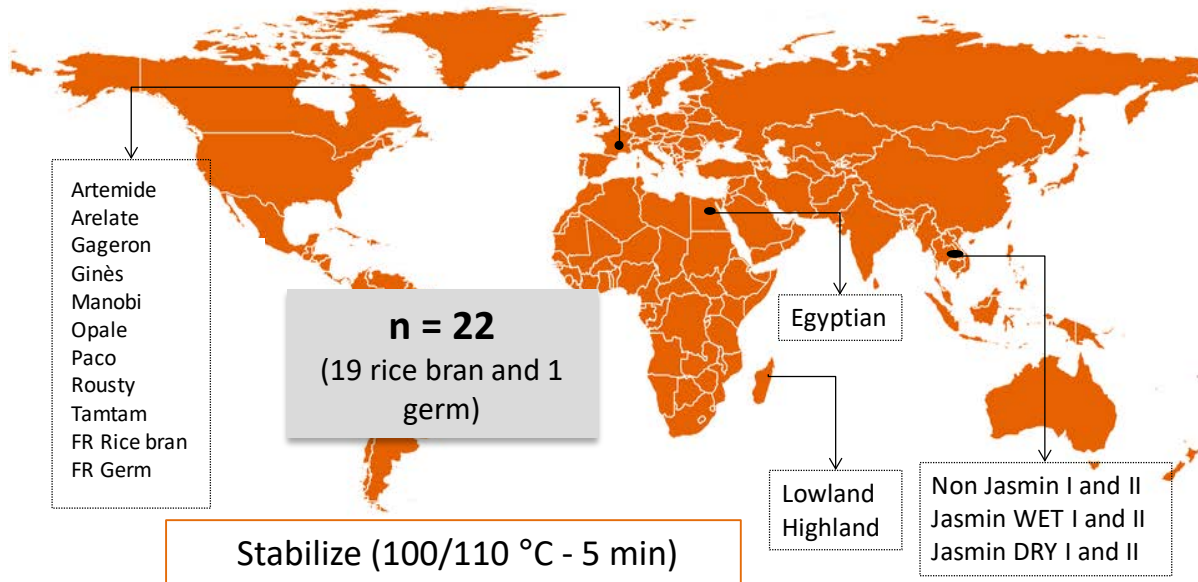
CONTEXT



Research interest for the sustainable valorization of rice coproducts for improving human health is high and linked to the presence of potential bioactive compounds.



Objective: physico-chemical characterization of a collection of rice brans focusing on lipids and phenolic compounds



RICE BRAN CHARACTERIZATION

PHYSICAL

- **Aw**
- **SIZE OF PARTICLES**

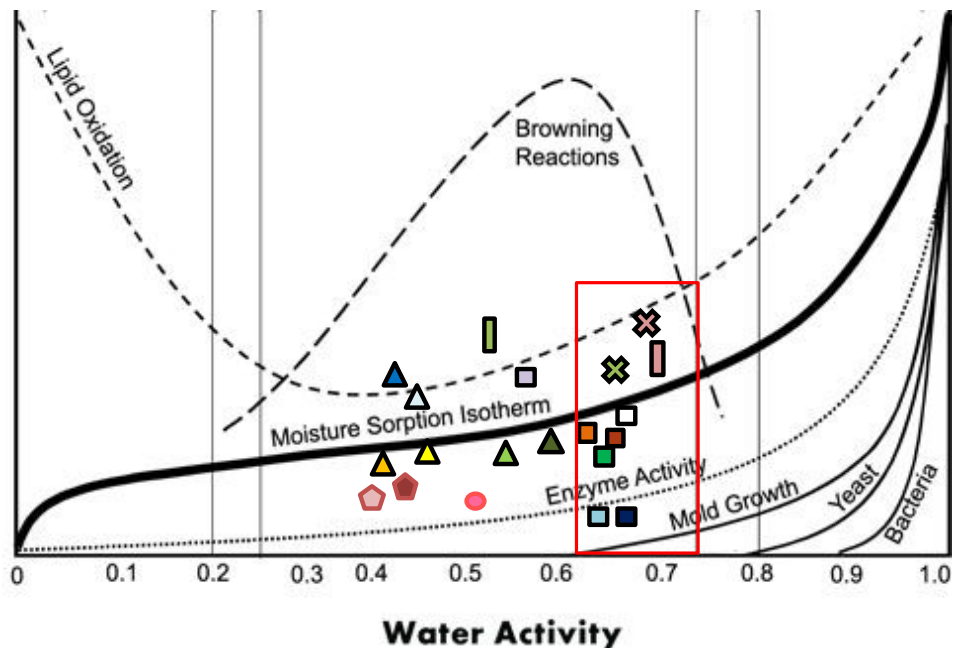
CHEMICAL LIPIDS

- **LIPIDS CONTENT**
- **CLASS OF LIPIDS BY TLC**
- **FATTY ACIDS METHYL ESTERS PROFILE BY GC**

CHEMICAL PHENOLIC

- **PHENOLIC COMPOUNDS CONTENT BY HPLC**
- **PHENOLIC PROFILE BY METABOLOMIC APPROACHES**

Aw



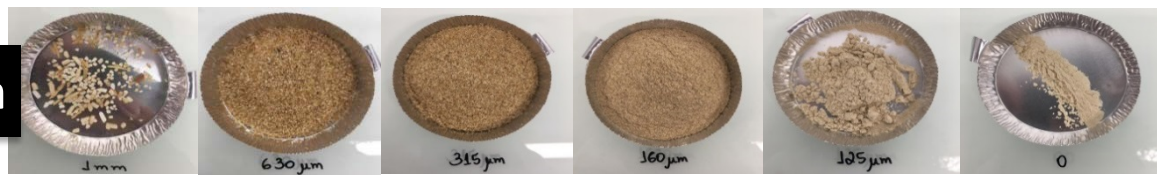
- Lowland
- Highland
- Non-Jasmin I
- Non-Jasmin II
- Jasmin WET I
- Jasmin WET II
- Jasmin DRY I
- Jasmin DRY II
- Egyptian
- Ginès
- Manobi
- Paco
- Gageron
- Rousty
- Opale
- Arelate
- FR Stab RB
- FR NO-Stab RB
- FR Stab Germ
- FR NO-Stab Germ

Aw = 0.53 (Khir and Pan, 2019)

Madagascar	Egypt	Cambodia	Camargue	FR
0.49 ± 0.02	0.52 ± 0.00	0.48 ± 0.07	0.63 ± 0.04	0.64 ± 0.08

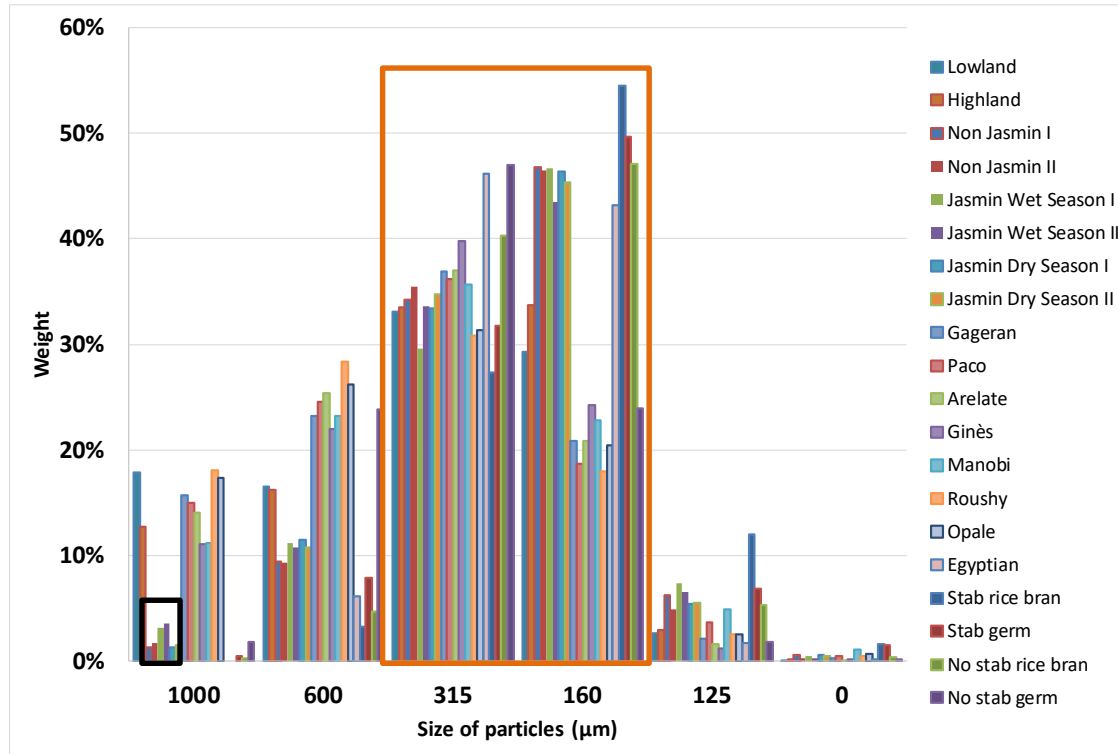


Particle Size Distribution



Jasmin Wet Season I

Heterogeneous particles distribution representative of variable milling processes



Large particles ($>1000 \mu\text{m}$) were not found in Cambodia's rice bran -> process / mechanical resistance;

Big amount of particles between 315 and 160 μm .

To normalize this heterogeneity, all samples were ground for further analysis.

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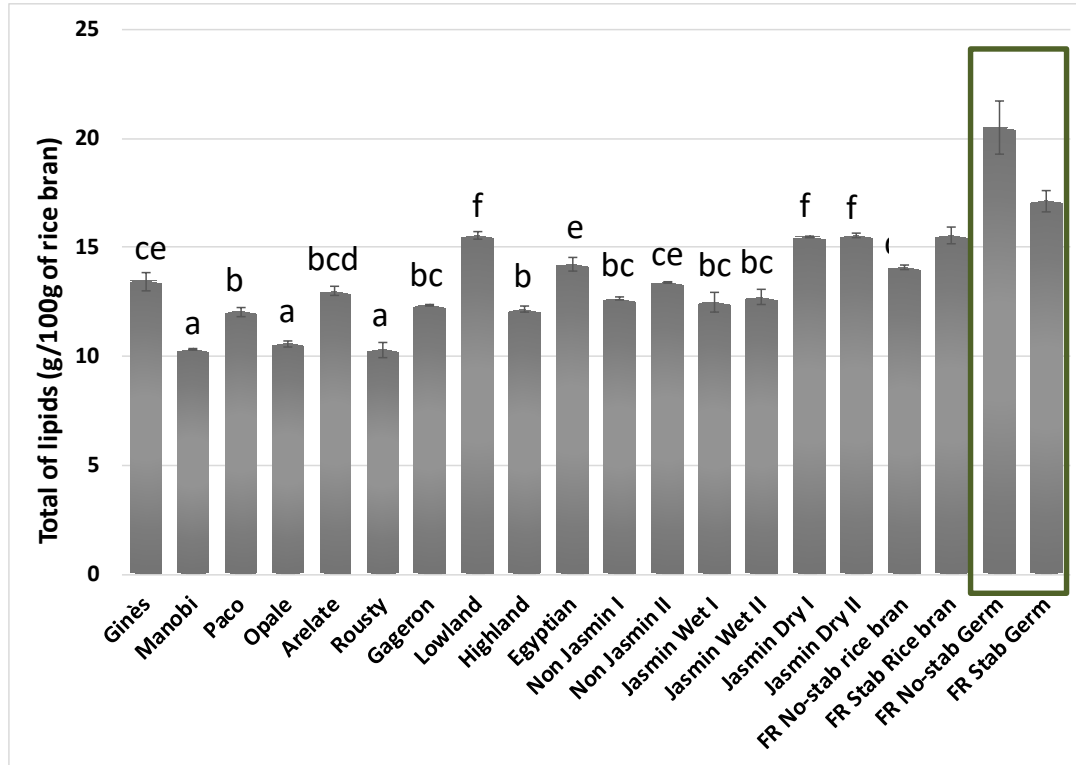
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TOTAL AMOUNT OF LIPID

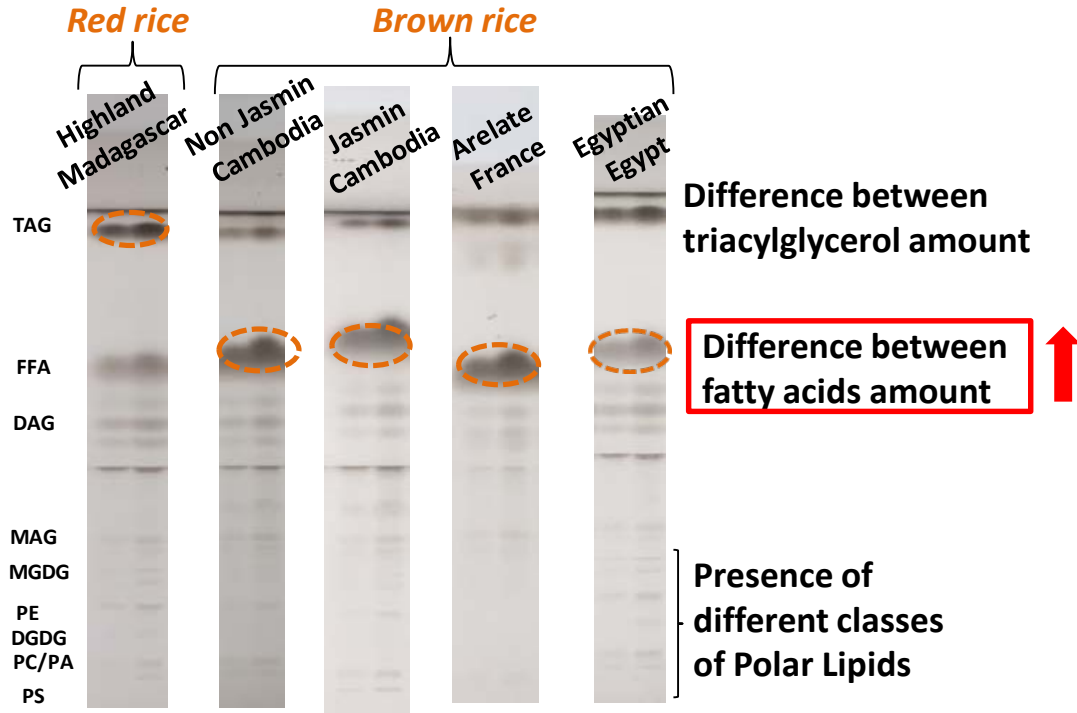


Literature value: ~15-20% of lipids (Khir and Pan, 2019);

Influenced by genotypes, conditions of culture;

Germ contains higher amount of lipids (Moongngarm et al., 2012);

LIPIDS CHARACTERIZATION



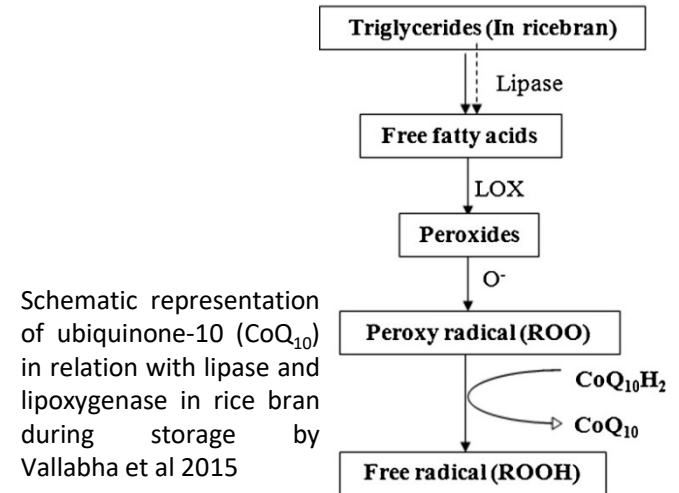
*Data treatment in progress**

Double migration:
Polar + Apolar solvent
Revelation: $\text{CuSO}_4/\text{H}_3\text{PO}_4$ -180°C 10 min

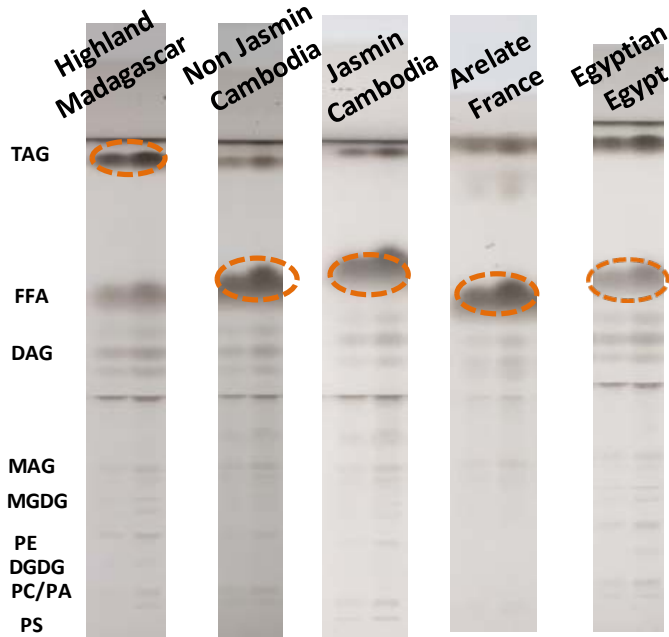
Possible enzymatic activity?

Endogenous enzyme in rice bran:
Lipase and peroxidase

Heat treatment for
enzymes inactivation

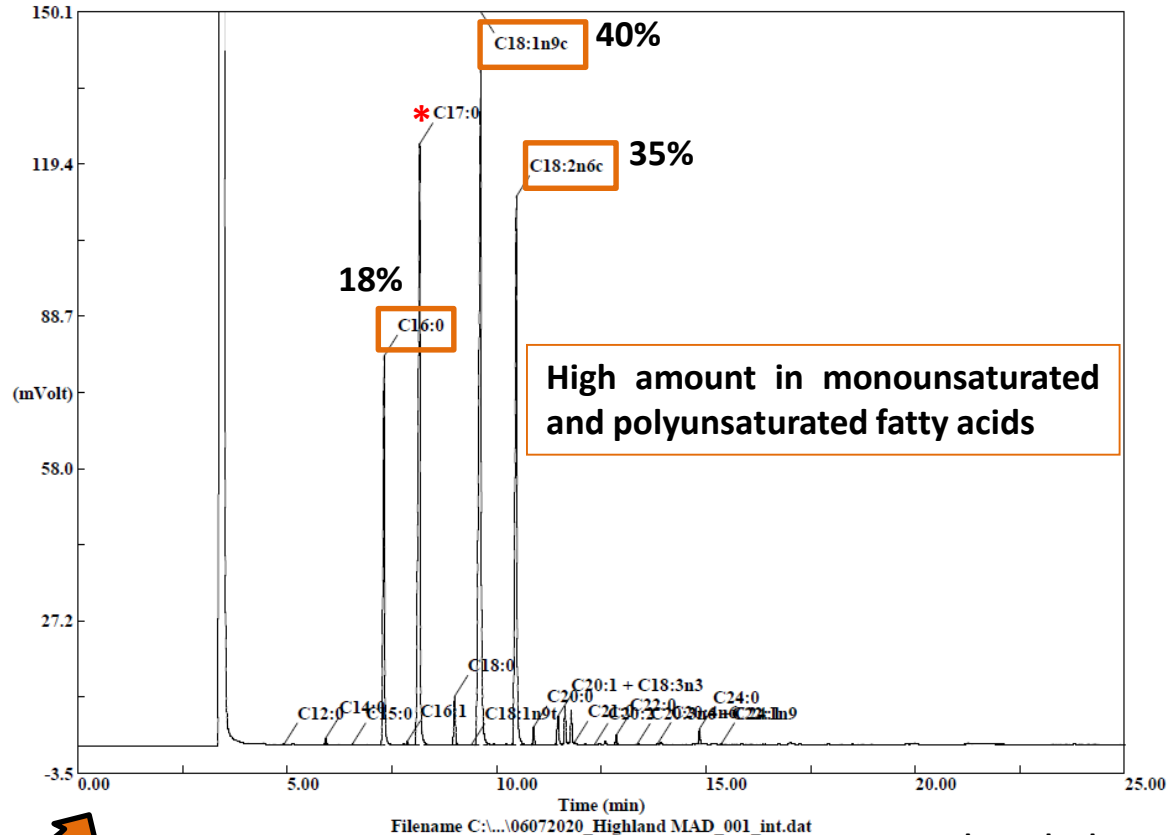


LIPIDS CHARACTERIZATION

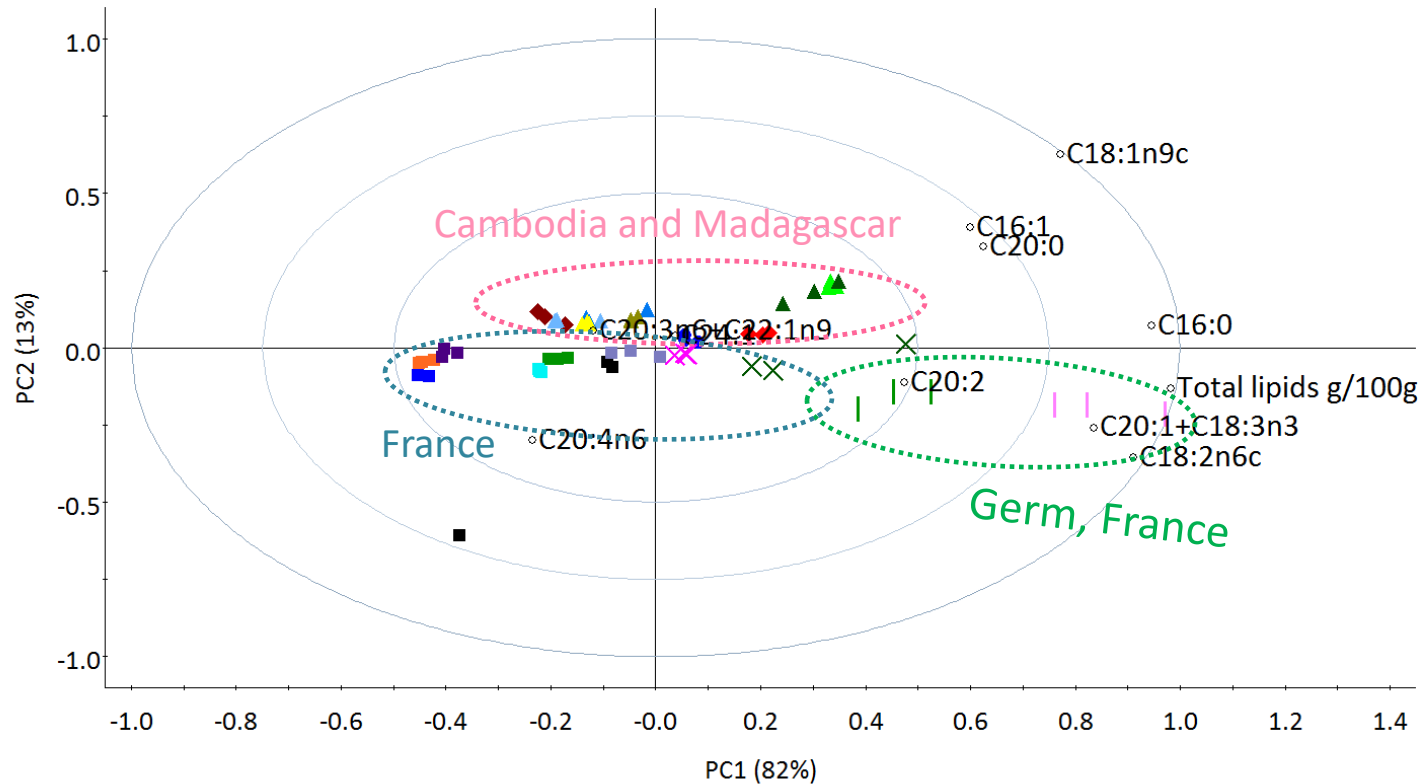


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LIPIDS CHARACTERIZATION



- Arelate
- Egyptian
- × FR Stab Rice bran
- × FR No-stab Rice bran
- Gageron
- FR No-stab Germ
- FR Stab Germ
- Ginès
- ◆ Highland
- ▲ Jasmin Dry I
- ▲ Jasmin Dry II
- ▲ Jasmin Wet I
- ▲ Jasmin Wet II
- ◆ Lowland
- Manobi
- ▲ Non Jasmin I
- ▲ Non Jasmin II
- Opale
- Paco
- Rousy
- X variables

Same profile of fatty acids but different contents (g/100 g) by location

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PHENOLIC CHARACTERIZATION

n = 2

(Tamtam – red and Artemide – black :
Camargue, France)



Conventional solvent



Deep eutectic solvents

DES1 – Choline chloride:1.2 propanediol

DES2 – Choline chloride:Lactic acid

○ Quantification of total phenolic acids by HPLC-DAD

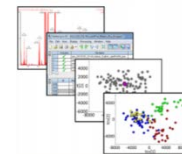


- HPLC-DAD at 280 nm
- C18 column
- Mobile phase A (MeOH, 0.1% acetic acid) and B (water, 0.1% acetic acid)

○ Metabolomic tools:



○ Identification:



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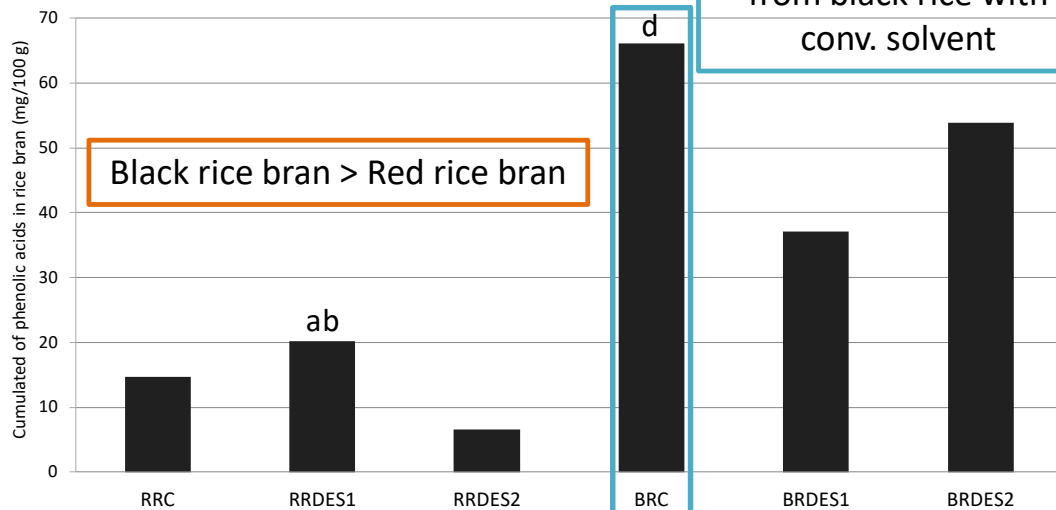
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Quantification of total phenolic acids (PA) by HPLC-DAD



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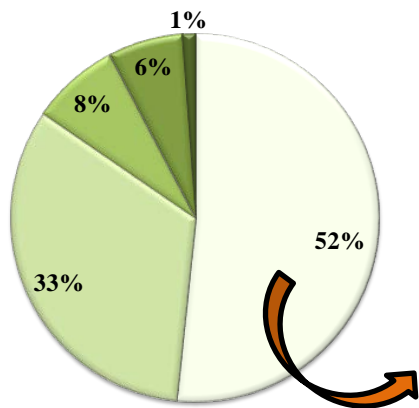
○ Total de 89 phenolic compounds (PC) ID:

○ By extract:

- ✓ Conventional: 84 ID
- ✓ DES1: 54
- ✓ DES2: 65

○ In common:

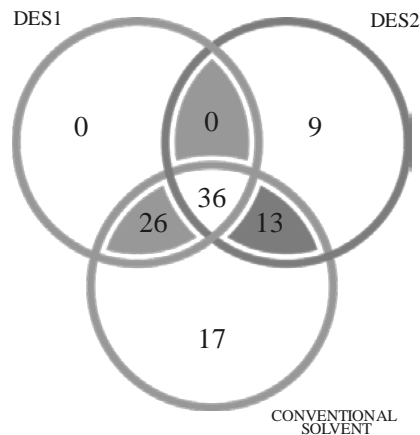
- ✓ Black rice bran: 36 ID
- ✓ Rouge rice bran: 12 ID



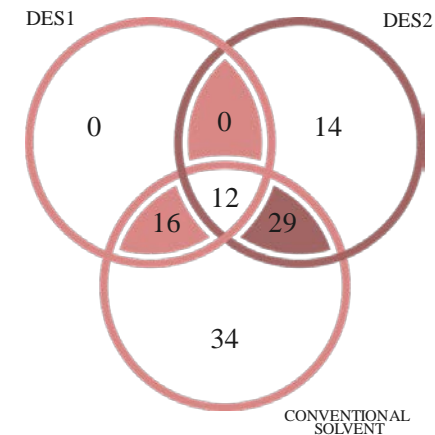
- Flavonoids
- Phenolic acids
- Other polyphenols
- Lignans
- Stilbenes

Flavonoids are the most abundant in this study

Black rice bran (Total ID: 88 PC)



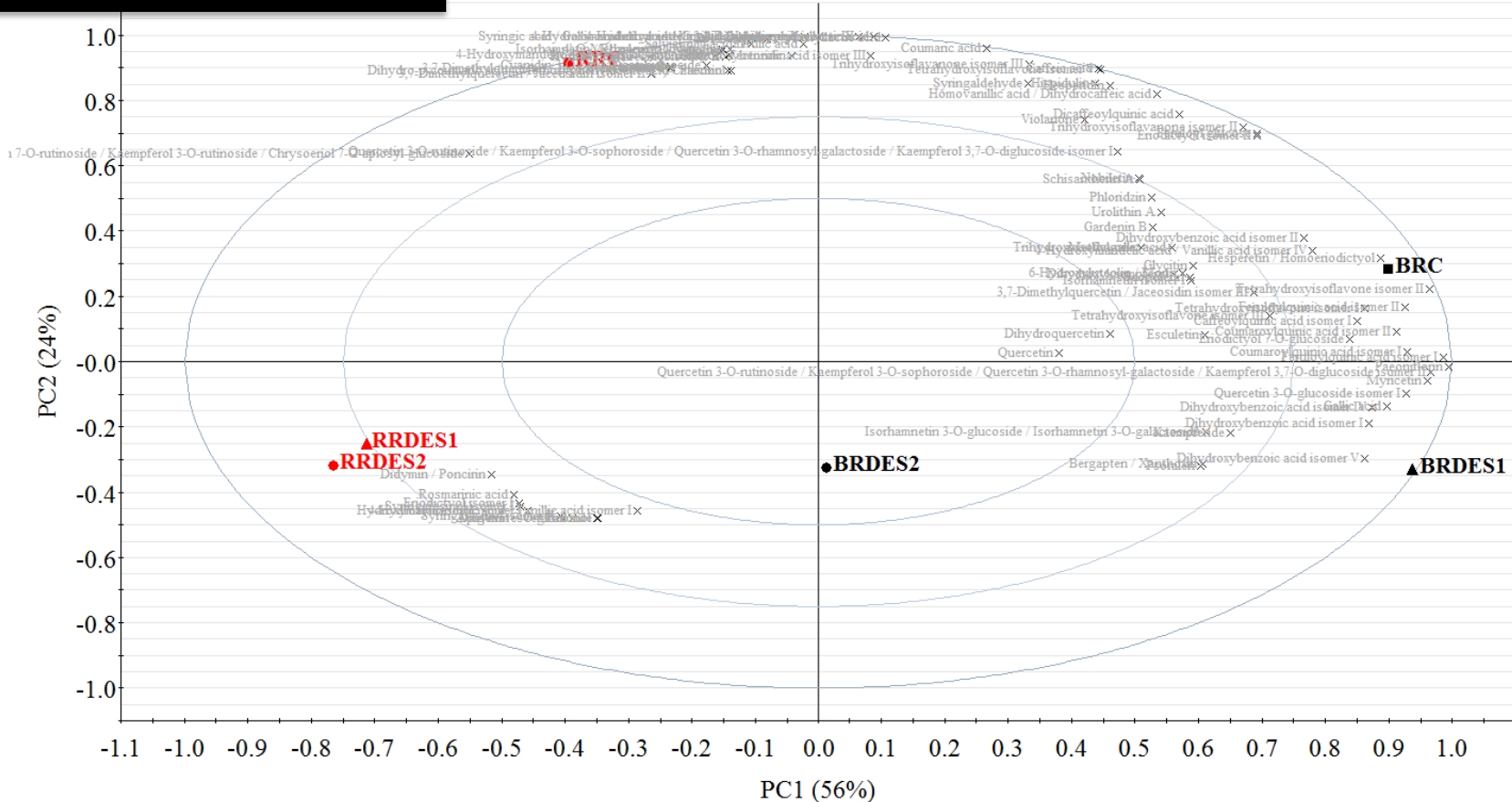
Red rice bran (Total ID: 81 PC)



- **DES2 was able to extract specific phenolic compounds**
- **The ID number in black rice was higher than red rice in all extracts analyzed**

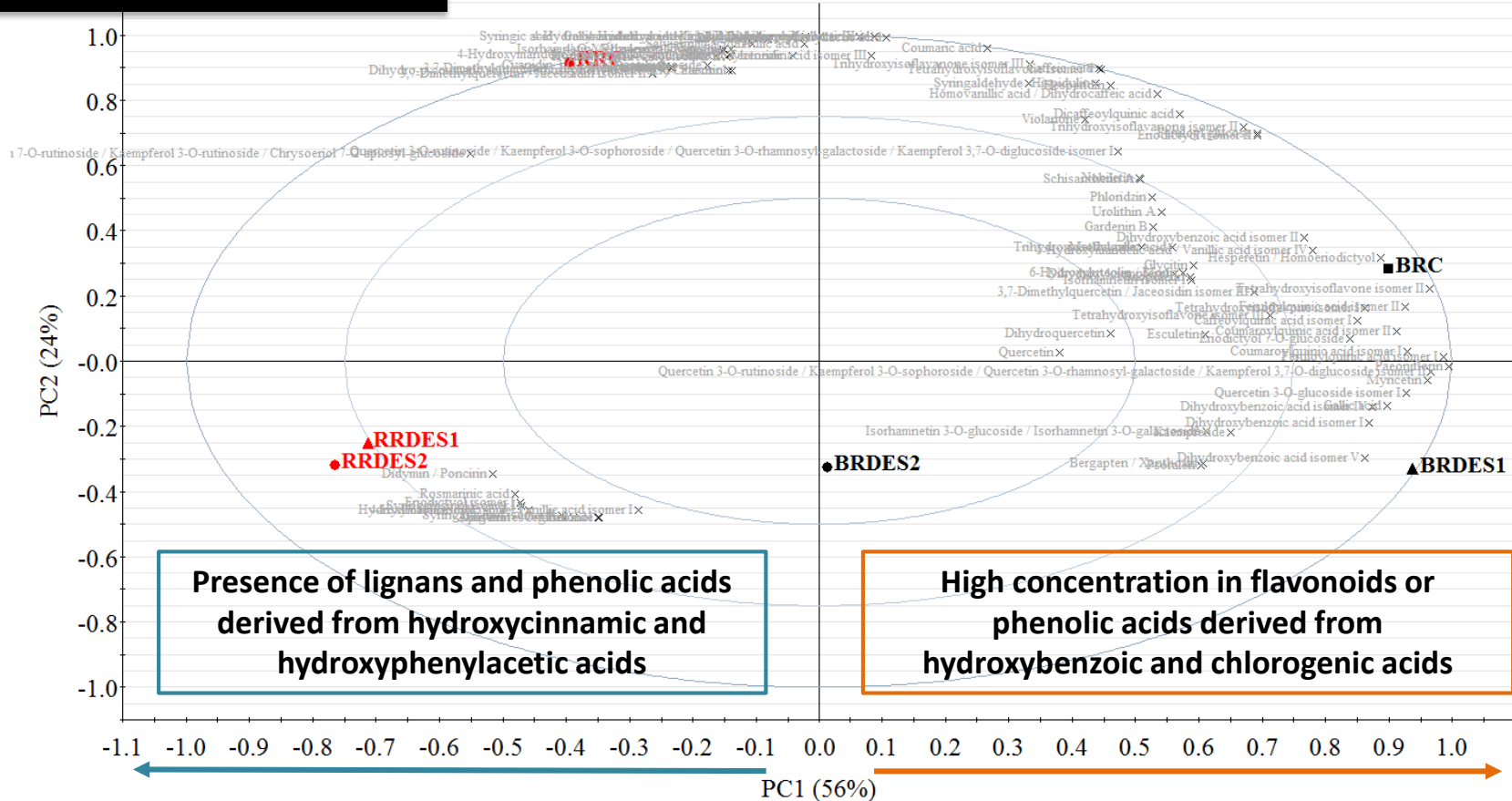
PHENOLIC CHARACTERIZATION

Loadings Bi Plot Comp[1] vs. Comp[2] colored by Rice bran extract



PHENOLIC CHARACTERIZATION

Loadings Bi Plot Comp[1] vs. Comp[2] colored by Rice bran extract



CONCLUSION AND PERSPECTIVES

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- ✓ Aw values: must be mastered to improve the conservation of rice bran and avoid the proliferation of microorganisms to be safe for human consumption

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LIPIDS CHARACTERIZATION

- ✓ All rice bran: rich source of lipids including bioactive classes (polar lipids, vit E, γ -oryzanol), high amount of FFA though
- ✓ Total lipid profile: influenced by genotype, localization of production and post-harvest conditions
- ✓ Fatty acid composition: high in unsaturated

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PHENOLICS CHARACTERIZATION

- ✓ Black and red rice bran are rich and can be a source of phenolic compounds
- ✓ Deep eutectic solvents can be a alternative to conceive new-pigmented rice bran formulations and permit applications to improve the health benefits

Thanks for your attention



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