Adaptive evolution to improve acid tolerance in 
*Oenococcus oeni*

Frédérique Julliat, N. Tourti, Stéphane Guyot, Hervé Alexandre, Cosette Grandvalet

▶ To cite this version:

Frédérique Julliat, N. Tourti, Stéphane Guyot, Hervé Alexandre, Cosette Grandvalet. Adaptive evolution to improve acid tolerance in *Oenococcus oeni*. 11th international symposium of oenology of Bordeaux, Jun 2019, Bordeaux, France. hal-03150729

HAL Id: hal-03150729
https://hal-agrosup-dijon.archives-ouvertes.fr/hal-03150729

Submitted on 24 Feb 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.
Oenococcus oeni is a lactic acid bacterium (LAB) mainly responsible for the malolactic fermentation (MLF) in wine. MLF plays an important role in determining the final quality of wines(1). Even though this LAB is naturally present in musts, wines and oenological environment, spontaneous MLF are usually unpredictable because of the stressful conditions and especially due to acidity(2). The consequence of the mismanagement of this step might lead to the depreciation of wine quality.

To obtain a clone more tolerant to acidity, we undertook a replication of O. oeni until 450 generations in a temporarily varying environment (pH 5.3 to 2.9) to improve acid tolerance. To discriminate stress tolerance of evolved populations versus parental strain an acid stress was performed to both population.

### Strategy involved

#### Parental versus evolved strains to extreme acidity challenge

1. **Intracellular pH in growth conditions or during acid stress at pH 1.9**
   - Evolved strains maintain their intracellular pH even when they grow at pH 2.9
   - Either parental nor evolved strain are able to regulate their intracellular pH during an acid stress at pH 1.9

2. **Plasma membrane permeability after acid stress at pH 1.9**
   - Compared to parental strain, evolved strains hold their membrane integrity for at least 30min during an acid stress
   - This state seems to be temporary; all strains become permeable after 90 min

3. **Lost of cultivability of evolved strains after a recovery to initial pH 5.3**
   - Evolved strains resist better than parental strain at an acid stress at pH 1.9
   - This resistance may be due to adaptation or acclimatization of cells
   - Return to initial pH 5.3 disrupt advantage of evolved strains
   - The resistance of evolved strains at pH of 1.9 does not seem to be due to adaptation but rather to a transitional acclimatization of cells

### Conclusions and perspectives

- Evolved strains maintain the same intracellular pH in acidic conditions (pH 2.9) than the parental strain in optimal conditions (pH 5.3)
- Tolerance to acidity of evolved strains is a transitional state which could optimize MLF performance in oenological conditions
- Further works will focus on genome sequencing and transcriptome (RNAseq).

### References