A Saccharomyces cerevisiae bio-databank for winemaking strain selection

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ABSTRACT

The winemaking industry faces an increased demand for novel Saccharomyces cerevisiae strains that are well-adapted to different wine styles and that contribute to improved aromatic characteristics. In this reasoning, the COST in the Biologically Appropriate Winemaking (CBMA) at the University of Minho gathered one of the largest bio-databases of S. cerevisiae, obtained from winemaking environments in Portugal and France. During the harvest time of 2008 to 2009, 604 grape samples were collected in appellations of origin in Portugal (Vinho Verde, São, Douro, Bairrada, Leiria, Trás-os-Montes, Estremadura, Batalha, Ribatejo, Alentejo, and Faro) and France (Languedoc). The grape samples belonged to the varieties Alvarinho, Azal, Arinto, Averno, Baga, Bical, Canete, Castelão, Catopsis, Encruzado, Maria Gomes, Terrantez, Touriga Nacional and Verdelho. Yeast populations, in particular S. cerevisiae, were isolated after spontaneous fermentation of the extracted grape juice. From the final stage of 250 fermentations, 7140 yeast isolates were obtained, belonging mostly (92%) isolates to the species S. cerevisiae. An initial genetic screen, based on intron insertion DNA restriction fragment length polymorphism (insertion RFLP), electrophoretic karyotyping or interdeltal sequence analysis, was followed by cosmid analysis and multilocus analysis of polymeric microsatellites. All isolates were assigned to 752 different strains, based on their microsatellite DNA fingerprinting.

The collection of 643 authentic S. cerevisiae strains is available at the site of the Saccharomyces cerevisiae wine Strain Collection: http://sowc.bio.uninho.pt/

INTRODUCTION

It is preferable to conduct fermentations with Saccharomyces cerevisiae strains that were isolated from the same wine regions because such strains:

- May have a better ability to dominate the non-desirable microbial flora;
- Can influence the typical profile of wines from each region in a positive way;
- Are better adapted to the micro-ecosystem and climate of each region;
- Their use ensures the production of wines with consistent and uniform quality in consecutive years.

Among the about 200 S. cerevisiae active dry yeast that are commercially available, only three strains were isolated in Portugal (Vinho Verde, São and Bairrada wine regions):

- From the biological materials that were collected in several research projects during the last years [1,2,3,4], a strain collection of autochthonous S. cerevisiae strains was constituted and characterized. A data set for each strain is now available at the site: http://sowc.bio.uninho.pt/.

METHODS

Sampling points in the appellations of origin in Portugal and France

Yeasts isolation

In each vineyard, 2kg of grapes were aseptically collected in six sampling points. The extracted grape juice was fermented, and the fermentation progress was monitored by daily weight determinations. In the final fermentation stage, 30 isolates were obtained and stored (-80°C) for later DNA isolation and molecular identification.

S. cerevisiae strains characterization

The isolates obtained were characterized by interdelta sequence analysis (A) or mitochondrial DNA restriction analysis (B). When isolates from different samples showed identical pattern, one representative strain of the group of strains was further studied by the allelic combination of 6 polymorphic microsatellites (C).

RESULTS

The gathering of all data led to the creation of a bio-databank of autochthonous S. cerevisiae strains (Saccharomyces cerevisiae wine strain collection), that is available at the site http://sowc.bio.uninho.pt/. This database contains all microsatellite data and allows different searches among the S. cerevisiae strains, according to the wine region, vineyard, grape variety and year of isolation.

Number of Saccharomyces cerevisiae strains obtained

<table>
<thead>
<tr>
<th>Wine Region</th>
<th>No of Strains</th>
<th>No of Isolates</th>
<th>No of Strains per 10 Vials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vinho Verde</td>
<td>282</td>
<td>115</td>
<td>550</td>
</tr>
<tr>
<td>São</td>
<td>818</td>
<td>494</td>
<td>168</td>
</tr>
<tr>
<td>Bairrada</td>
<td>168</td>
<td>72</td>
<td>216</td>
</tr>
<tr>
<td>Total</td>
<td>604</td>
<td>238</td>
<td>712</td>
</tr>
</tbody>
</table>

Saccharomyces cerevisiae wine strain collection

CONCLUSIONS

The collection of S. cerevisiae strains is an important resource for:

- Selection of winemaking strains that could be used to produce wines with characteristic aromas;
- Ecological studies and biodiversity conservation;
- Sustainable development of genetic resources;
- Equitable sharing of genotypic and phenotypic data.

Ongoing studies aim to assess the enological characteristics of the collection to select the strains that are most suitable for the fermentation of wines from the corresponding winemaking regions, in an approach that we call “wine à la Carte.”

References


Acknowledgments

This work was financially supported by the programs: POCI 2010/FEDER/FCT, POCI/AGCR/55132/2010 (PTDC/AGB-10/0592/2008) and the European Community’s Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 228454.