When less is more: streamlining the interspecific hybrid yeast genome for improved fermentation

Jenny Bellon, Mark Solomon, Simon Schmidt

The Australian Wine Research Institute, PO Box 197, Glen Osmond (Adelaide) SA 5064, Australia

Corresponding author's email: jenny.bellon@awri.com.au

Introduction:

While *Saccharomyces cerevisiae* wine strains are the mainstay of commercial wine production, there are indications that other species can contribute to sensory complexity and improve palate structure. One strategy to introduce non-*S. cerevisiae* inputs whilst ensuring robust fermentation kinetics is to generate interspecific hybrids between a *S. cerevisiae* wine yeast and other species of the *Saccharomyces* genus.

Chromosomal loss from one or both parental lineages is a feature of many naturally occurring interspecific hybrids. This indicates that interspecific hybrids with complete parental genomes may not have the maximum potential for fitness and fermentation competence. This work explores the path to optimising performance of interspecific hybrid yeast through meiosis-induced chromosomal loss (streamlining).

Method:

Yeast mating was used to generate an interspecific hybrid between a *S. cerevisiae* wine yeast and *Saccharomyces paradoxus*. Meiosis (a type of cell division that is a natural life-cycle event for yeast) was induced in the hybrid yeast strain to initiate chromosomal reduction. Resultant progeny with variable chromosomal complements from either parent were screened for alterations to fermentation kinetics and production of wine flavour-active compounds.

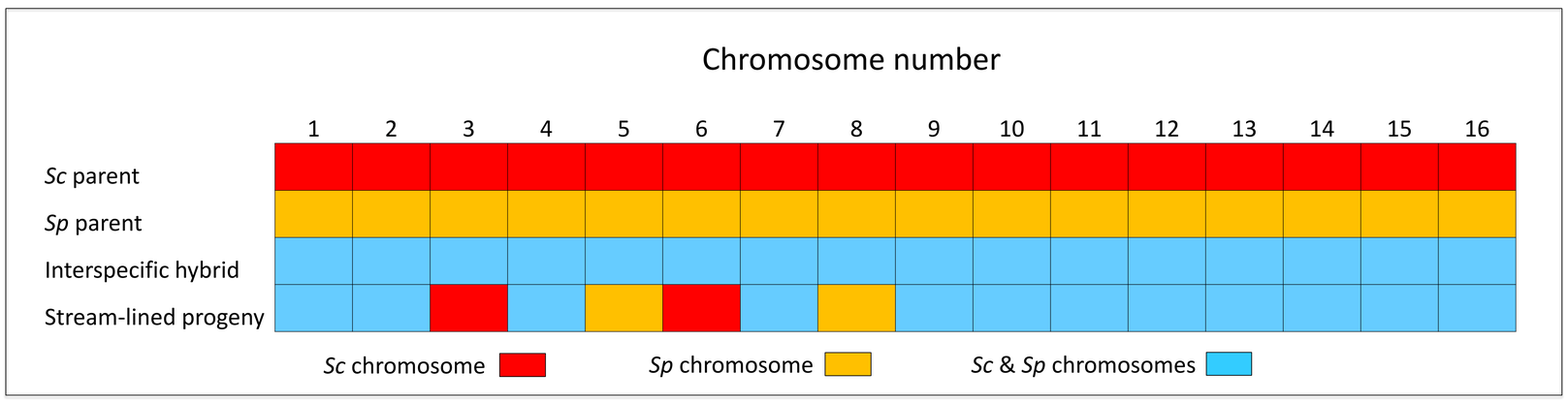

Figure 1. Species contribution to hybrid yeast chromosome complement

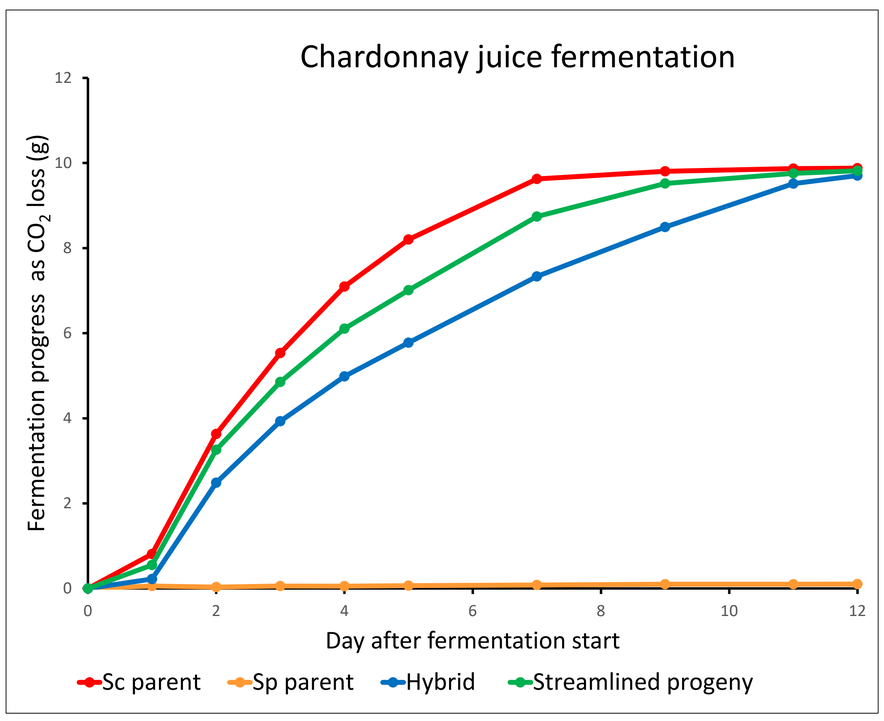

Figure 2. Improved fermentation kinetics of optimised hybrid

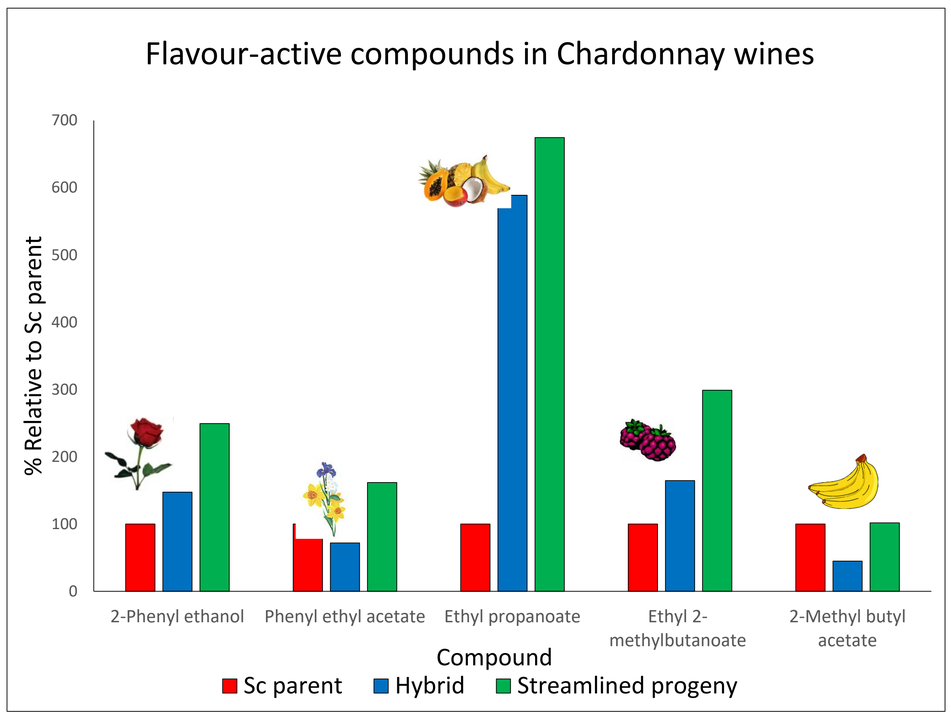

Figure 3. Retention of hybrid aromatic profile by optimised hybrid

Results:

Genetic analysis of interspecific hybrid meiotic progeny identified a strain that had lost *S. paradoxus* chromosomes 3 and 6, and *S. cerevisiae* chromosomes 5 and 8 (Figure 1). This genetically streamlined hybrid progeny strain displayed improved fermentation kinetics relative to the original hybrid in Chardonnay juice (Figure 2). Chemical analysis of the wines confirmed that the altered profile of aromatic compound production observed in the original hybrid was retained in the streamlined progeny strain (Figure 3).

Conclusion:

Using the natural life cycles of yeast mating and meiosis can generate interspecific wine yeast hybrids with improved fermentation kinetics that also deliver flavour and aroma novelty to wines.