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Domestication of microbial community in action : a participatory research and multidisciplinary study of sourdough bread

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Since the Neolithic time, until nowadays, humans have recurrently selected microbial community for making fermented food and beverage. This represents a good opportunity to study the community ecology and evolution of microbial ecosystem during ongoing domestication.

Using sourdough bread as a model system and an interdisciplinary approach including bakers, farmers, sociologist, bio-mathematicians and biologists, we analyzed the impact of human on the diversity and evolution of microbial communities in France. Natural sourdough bread is made of wheat flour, water and sourdough. Sourdough is composed of flour, water, bacteria and fungi. Bakers initiate a new sourdough by mixing flour and water, and maintained it by regular feedings with flour and water, a process called back-slopping.

Using a social survey of bread-making practices and a microbial ecologist approaches, we showed that bread-making practices impact sourdough microbial species diversity. Farmer-bakers maintained different yeast species than bakers. In addition, we revealed convergent phenotypic evolution of sourdough strains of different yeast species for fermentation traits indicating that bakers have independently selected for phenotype of interest regardless of the yeast species. Finally, we realized an experiment of domestication in action by asking four bakers to initiate new sourdoughs with six different flours. The weekly followed up of sourdough species composition revealed that, for each baker, a single yeast and a single bacteria species dominated the community after 3 weeks of back-slopping. Despite the introduction of new bacteria and yeast from the flour at each back-slopping, the dominant species was the one present in the home sourdough indicating that dispersion and selection occurred mostly within the bakery. All together our study highlighted that domestication of microbial community can be a good model to bridge community ecology and evolution, to study the adaptation dynamic and the genetic architecture of fast evolving traits involved in abiotic and biotic interactions.