German researchers figure out how lager first developed in Bavaria

April 27 2023

Pilsner-style lager. Credit: John Morrissey/ FEMS Yeast Research

A new paper in *FEMS Yeast Research* reveals the possible origin story of lager beers. Using historical records and contemporary phylogenomics research, investigators here show where lagers likely first originated: at

the court brewery (Hofbräuhaus) of Maximilian the Great, elector of Bavaria, in Munich in 1602.

Beer has been made since ancient times. Recent archaeology shows evidence of brewing in the eastern Mediterranean some 13,000 years ago. Although from the origins of brewing until the early 20th century, ale was the typical beer produced, lager now accounts for approximately 90% of the beer consumed annually.

The beginnings of this shift from ale to yeast occurred when a new yeast species, *Saccharomyces pastorianus* or "lager yeast," appeared in Germany around the end of the middle ages. This is a hybrid species that arose from mating the top-fermenting ale yeast *Saccharomyces cerevisiae* and the cold-tolerant *Saccharomyces eubayanus* around the start of the 17th century. But until now no one has figured out how the combination lager yeast *S. pastorianus* came about.

The general assumption was that the hybrid arose when a traditional *S. cerevisiae* ale fermentation became contaminated with wild yeasts including *S. eubayanus*. But the researchers here believe this is doubtful. Using a detailed analysis of Central European historical brewing records, they discovered that "lager-style" bottom fermentation was happening in Bavaria from at least two hundred years earlier.

They propose an alternative hypothesis that it was *S. cerevisiae* that contaminated a batch of beer brewed with *S. eubayanus*, rather than the other way around. And in an intriguing piece of detective work, they identified what they believe to be the source of the contaminating S. *cerevisiae*—a wheat brewery in the small Bavarian town of Schwarzach.

Beer was always a valuable commodity and its production was regulated carefully. In Bavaria a brewing ordnance from 1516 (the famous "reinheitsgebot") permitted only bottom fermentation and brewing of

"lager-style" beer. But in neighboring Bohemia, excellent wheat beer made with *S. cerevisiae* was produced and vast quantities were imported into Bavaria. To limit the economic damage from these imports, in 1548 the Bavarian ruler, Wilhelm IV gave Baron Hans VI von Degenberg a special privilege to brew and sell wheat beer in the border regions to Bohemia.

When the grandson of Hans von Degenberg failed to produce an heir, the family finally died out and, in 1602, the new Bavarian ruler, Maximilian the Great, seized the special wheat beer privilege himself and took over the over the von Degenbergs' Schwarzach breweries. In October of that year, the yeast from the wheat brewery was brought to the Duke's court brewery in Munich, where the researchers propose the famous hybridization took place and *S. pastorianus* was born. After that, the researchers here show, *S. pastorianus* strains from Bavaria spread all over Europe and are the source of all modern lager yeast strains.

The results of the researchers' investigation of the historical record, together with published phylogenomic (evolution and genomics) data, suggest that the dominance of *S. pastorianus* lager yeast developed in three stages. First, the yeast strain *S. cerevisiae* came to Munich from Bohemia, where brewers had made wheat beer since at least the 14th century. Second, the *S. cerevisiae* that was introduced into the Munich brewery in 1602 mated with *S, eubayanus*, which was already involved in making Munich-style beer, to give rise to *S. pastorianus*. And finally, the new *S. pastorianus* yeast was distributed around Munich breweries first, and then throughout Europe and the world. The researchers here note that the co-occurrence of *S. pastorianus* with the technologically advanced brewing methods in Munich, and the willingness of Munich brewers to share knowledge (and actual yeast) may have contributed to the strain's dominance.

"There is a certain irony that the inability of Hans VIII von Degenberg to

produce a son triggered the events that led to the creation of creation of lager yeast, said Mathias Hutzler, one of the paper's lead authors. "As one lineage died out, another began. No heir—but what a legacy he left for the world!"

More information: A new hypothesis for the origin of the lager yeast Saccharomyces pastorianus, *FEMS Yeast Research* (2023). DOI: 10.1093/femsyr/foad023

Provided by Oxford University Press