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Researchers Identify 3 Yeast Strains That Block a Stubborn Wine Spoiler in the Lab

The strains inhibited Brettanomyces bruxellensis across six genetic groups without affecting commercial starter yeasts.

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Researchers have identified three yeast strains from the Lachancea genus that strongly inhibited the wine spoilage yeast Brettanomyces bruxellensis in laboratory tests, offering a possible new route to control one of the wine industry's most persistent

microbial problems.

The findings were published Wednesday in the journal OENO One. The study examined whether certain Lachancea yeasts produce so-called killer activity against B. bruxellensis, a species known for causing off-flavors in wine and for surviving conditions that can suppress other microbes. The researchers said the work was designed to explore biological alternatives to chemical preservatives, especially as some B. bruxellensis strains show tolerance to sulfur dioxide, one of the sector's main protective tools.

B. bruxellensis is widely regarded as a major spoilage organism in dry red wines. It can produce volatile phenols and other unwanted compounds linked to aromas often described as medicinal, smoky, leathery or similar to barnyard notes. It can also persist during winemaking and later reappear during aging, which makes it difficult to manage once contamination is established.

In the new study, the researchers screened 17 Lachancea isolates against 29 B. bruxellensis strains drawn from six major genetic groups. They also tested the Lachancea yeasts against other wine-associated species, including both spoilage and beneficial yeasts, as well as nine commercial wine starter cultures. The experiments were carried out on grape-juice agar adjusted to pH3.5, a level the authors described as representative of average wine acidity, at 24°C.

Ten of the 17 Lachancea isolates showed some degree of growth inhibition against spoilage yeasts. But three strains stood out for producing a strong and consistent effect against B. bruxellensis across all six of the target species' main genetic groups. Those strains were Lachancea thermotolerans CTL 302, Lachancea thermotolerans CTL 277 and Lachancea waltii NRRL Y-8285.

The study said these three strains caused a permanent growth inhibitory effect against the B. bruxellensis strains tested. Just as important for winemakers, the researchers reported that the same three Lachancea strains did not show killer activity against any of the commercial wine yeasts included in the trial. That result suggests they may have selective value as biocontrol agents, because a control organism that also harms starter cultures would be harder to use in production.

The authors also tested whether lactic acid might explain the observed inhibition. Lachancea thermotolerans is known for producing lactic acid, which can affect wine acidity and microbial behavior. But in this study, lactic acid at concentrations ranging from 3g/L to 18g/L did not effectively inhibit the spoilage yeasts tested. The researchers concluded that lactic acid was not responsible for the killer effect.

To better understand what was causing the inhibition, the team analyzed concentrated supernatants from the three most active strains and exposed them to heat and to a protease treatment using pepsin. Based on those tests, the inhibitory compound behaved like a killer toxin rather than a simple acidification effect. That matters because killer toxins are secreted molecules that can target other yeasts, making them attractive candidates for microbial control if they remain active under real production conditions.

The study adds to a growing search for alternatives to sulfur dioxide and other conventional methods used against B. bruxellensis. Physical methods such as filtration and cellar hygiene remain standard in wineries, but they do not always provide lasting control. Other approaches, including chitosan and newer physical treatments, can work under some conditions, but their effectiveness may depend on strain type, pH or regulatory limits.

The paper also places the problem in a broader genetic context. B. bruxellensis is not a single, uniform target. The species includes multiple genetic groups associated with different substrates and ploidy levels, and prior research has shown that these groups can respond differently to control measures. Most strains are diploid, but about 40% carry an additional haploid genome and are triploid. That diversity helps explain why a treatment that works on one strain may fail on another, and why broad screening matters before proposing a commercial solution.

According to the study, current sulfur dioxide targets recommended for preventing B. bruxellensis spoilage can be difficult to reach in wines with pH above 3.5. The authors also noted earlier research suggesting that years of heavy reliance on sulfur dioxide may have helped select more tolerant B. bruxellensis groups, particularly A2 and D1/D2 populations. In that context, a biological tool that can suppress a wide range of

genetically distinct strains without disrupting desired fermentation yeasts could be valuable for producers.

For the beverage sector, especially wineries dealing with spoilage risk during fermentation or aging, the results point to a potential form of bioprotection that might help reduce losses and limit dependence on chemical preservatives. That could be particularly relevant where sulfite tolerance is a concern. Still, the findings remain limited to controlled laboratory conditions, and the study does not show that the same effect will occur in tanks, barrels or bottled wine.

That caution is central to the paper. The authors described the three Lachancea strains as promising potential biocontrol yeasts, but they also said more work is needed under real winemaking conditions. Lab assays on solid media can show whether inhibition exists, but they cannot fully reproduce the stresses of commercial vinification, including ethanol levels, nutrient competition, oxygen exposure, sulfur dioxide, mixed microbial populations and the long time frames involved in wine aging.

The study comes at a time when non-Saccharomyces yeasts are drawing more attention in winemaking, not only for aroma and texture effects but also for microbial management. Some strains of Lachancea thermotolerans are already used commercially for acid balance, especially in warm regions where grapes can reach high sugar and low acidity. A strain from the same genus that also helps suppress spoilage organisms would be of obvious interest, provided it performs reliably and safely outside the lab.

Previous reports had described anti-Brettanomyces activity in other yeasts, but the options have been limited by practical drawbacks. Some organisms were not isolated from wine environments, some were themselves considered potential spoilage yeasts, and others were sensitive to ethanol or sulfur dioxide, reducing their usefulness later in production. The new work stands out because it tested a broad panel of B. bruxellensis strains and found three Lachancea strains that did not harm the commercial wine yeasts evaluated.

The next step for researchers will be to determine whether those traits hold up during actual fermentation and aging, and whether the killer activity remains effective in the complex chemical and microbial environment of wine.