New yeast species travelled the globe with a little help from the beetles

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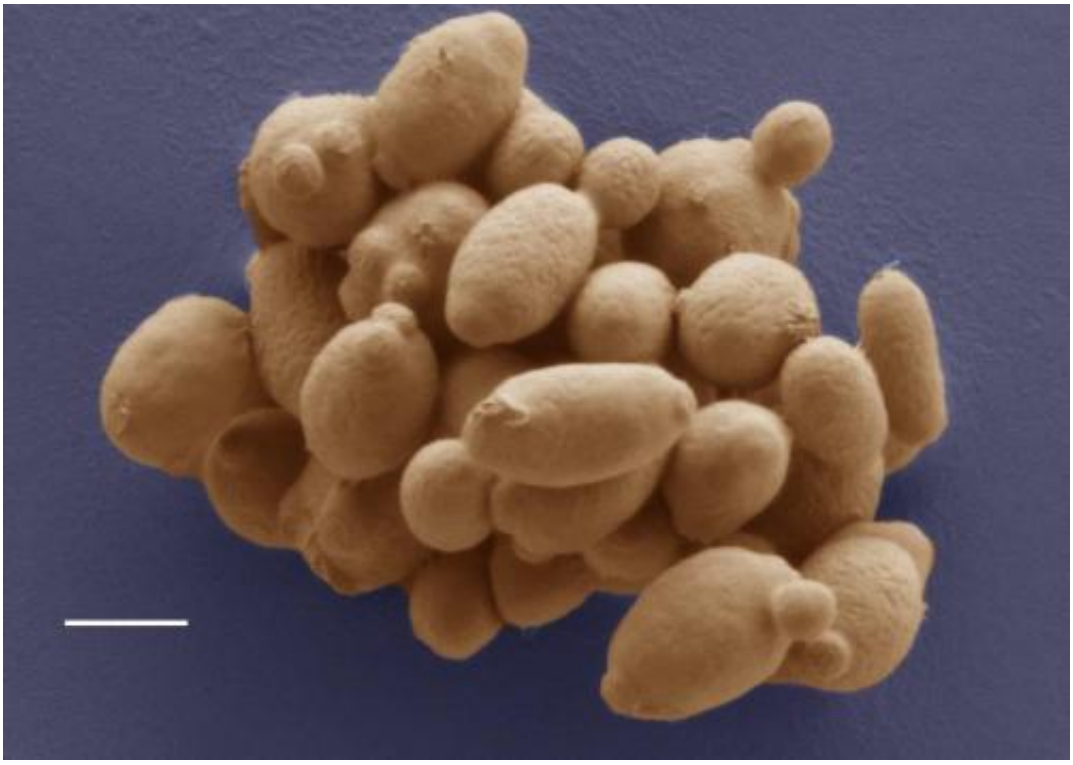

This shows *Wickerhamomyces arborarius* false colored SEM. Credit: Kathryn Cross, IFR

Researchers from the National Collection of Yeast Cultures (NCYC) at the Institute of Food Research (IFR) have identified a new globe-trotting yeast species that lives on tree-associated beetles. This new species demonstrates the importance of preserving biodiversity, as yeasts like this may help efforts to develop renewable fuel sources in the future.

Preserving biodiversity must go beyond plants and animals and also preserve the microbial life. Threats to habitats, for example through oil exploration, could destroy forever potential solutions to global challenges locked up in the microbial life itself. Yeasts, well known for their role in brewing beer and baking bread, can also ferment sugars from plant material into biofuels. However, this process isn't very efficient, especially when waste plant matter is used, as the structures are tough to break down.

Different yeasts use different types of sugars, thrive in different conditions and produce a diverse range of different products. Crossing strains with just the right mix of characteristics could produce a yeast that's perfect for biofuel production. The announcement of the production of the first artificial yeast chromosome demonstrates how using synthetic biology gives us an opportunity to design a new yeast with these characteristics. But identifying these relies on studying and preserving yeast biodiversity.

In an effort to address this issue, NCYC, which is based at IFR on the Norwich Research Park, has recently initiated a programme to screen its 4000+ different yeast strains to find the biofuel-producing stars. But it wants more.

"We're looking for interesting yeasts from interesting habitats," said Dr Steve James.

Xyleborus glabratus Redbay ambrosia beetle. Credit: Division of Plant Industry Archive, Florida Department of Agriculture and Consumer Services, Bugwood.org

The search for yeast biodiversity spans the globe, and has just yielded an entirely new species. Wickerhamomyces arborarius was first discovered on a flower growing in the high altitude Maquipucuna cloud forest in north-west Ecuador. It's the latest in a long standing collaboration between NCYC and the Colección de Levaduras Quito Católica (CLQCA) in Ecuador. The Ecuadorian team, led by Dr Javier Carvajal, has been scouring unique and sensitive habitats such as the cloud forests, the Amazon rainforest, the Andean highlands as well as the Galápagos Islands in search of novel yeasts, which NCYC then characterises and preserves.

With funding from the Biotechnology and Biological Sciences Research Council (BBSRC), NCYC have been characterising this yeast. Genomic

analysis of the Ecuadorean yeast revealed it had no known matches. But over time, other yeast hunters found similar strains of the Ecuadorean species. One was found on a nutgall tree in a remote mountainous region of Taiwan by Dr Ching-Fu Lee of the National Hsinchu University of Education. Three other strains were identified from wood-boring beetles living on laurel trees in Georgia, USA, by Dr Thomas Harrington from Iowa State University, whose research team were investigating how these beetles transmit a fungal pathogen known to cause laurel wilt disease.

"This new species is a real globetrotter," said Dr James. "It's possible the yeast originated in Asia, and was subsequently brought to the USA by these insects. Although this beetle has yet to be found in Ecuador, three other very similar species have recently been found there, so it's possible that the yeast got to South America via the beetles too."

Interestingly, one of the US strains was isolated from a beetle that had been surface sterilised, potentially indicating that this yeast species actually lives inside the insect, in its gut. This isn't unusual, as like us, insects host gut flora - bacteria and yeasts that help them digest their food. These particular beetles eat wood, and rely on their microbial gut flora to help digest its tough structure. The same structure is found in the sorts of waste plant materials that could be suitable sources of biofuels if only more efficient ways of realising their potential were available. If this yeast is indeed a gut symbiont of the beetles, it should also be resistant to some of the breakdown products from wood digestion that can inhibit other biofuel-producing yeasts.

The NCYC team are now fully characterising this new species, and plan to test what characteristics might be useful for the production of biotechnological applications.

"We're really interested in finding out how this yeast evolved tolerance to rotting wood environments, to guide attempts to improve production

yeasts," said Dr Ian Roberts, curator of the NCYC. "It's just the sort of characteristic you'd put into a designer yeast for biofuel production."

In testing and characterising yeast, he and his team work closely with Professor Keith Waldron and his colleagues in The Biorefinery Centre at the Institute of Food Research, which is strategically funded by the Biotechnology and Biological Sciences Research Council.

But their search for more yeasts to add to their collection continues. Conservative estimates put the current total number of yeast species at 150,000, and so far globally we've possibly discovered only 1% of this total. NCYC's Ecuadorean collaboration has yielded dozens of new, as yet uncharacterised yeasts, and more extreme environments and habitats are currently being explored for the chance to find potentially useful yeasts. But unless we preserve those habitats, and the precious biodiversity they contain, we could lose that chance forever.

More information: Wickerhamomyces arborarius f.a., sp. nov., an ascomycetous yeast species found in arboreal habitats on three different continents, Stephen A. James et al , *International Journal of Systematic and Evolutionary Microbiology*, (64) 3, 1057-1061 DOI: 10.1099/ijs.0.059162-0

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