Wood-munching fungus has genome decoded

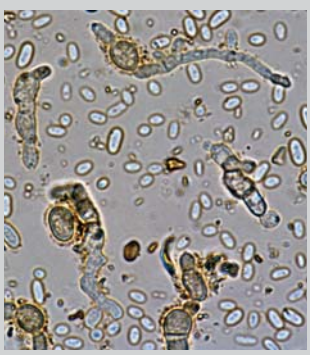
The research team: Prof. Alf Botha, MSc student CJ Borstlap, Dr Heinrich Volschenk and Dr Riaan de Witt.

A relatively unknown fungus, found by chance on an acacia tree in the Northern Cape, has emerged as a voracious wood-munching organism with enormous potential for industries that use biomass as a renewable resource.

The first time someone took note of *Coniochaeta pulveracea* was more than 200 years ago, when the South African-born mycologist Dr Christiaan Hendrik Persoon mentioned it in his 1797 book on the classification of fungi. Now *C. pulveracea* has had its whole genome sequenced by microbiologists at Stellenbosch University (SU), and henceforth made its debut in cyberspace with a few tweets and a hashtag. All because this relatively unknown fungus has an extraordinary ability to degrade wood – hence the species name '*pulveracea*', reflecting its ability to render something powdery.

In the age of biotechnology, biofuels and the use of renewable raw materials, this is an important fungus to take note of, says Professor Alf Botha, from SU's Department of Microbiology. While the ability of species in the *Coniochaeta* genus to rapidly degrade lignocellulose into fermentable simple sugars has been reported over the past 25 years, thus far Prof. Botha's lab is the only one working on *C. pulveracea*.

The work started in 2011, when he quite randomly snapped a brittle twig, covered in lichen, from a decaying acacia tree while holidaying on a farm in the Northern Cape. "At the time we were looking for fungi and yeasts that can break down wood, so I knew this was something special when I decided to keep the twig," he explains. To date, despite numerous attempts, they have not been able to find the fungus in the field again.



Heinrich Volschenk

Cells of the wood-eating fungus *Coniochaeta pulveracea* exhibit both unicellular yeast- and filamentous fungus-type characteristics while breaking down twigs from an acacia tree.

However, back in the lab there was great excitement when they observed that the fungus, in culture, was literally munching its way through birchwood toothpicks. Even more astounding was its ability to change form between a filamentous fungus and a unicellular yeast, depending on the environment – an unusual behaviour typically associated with fungal pathogens. Prof. Botha and his postgraduate students began investigating the fungus more closely, and in 2011 Dr Andrea van Heerden found that it produced enzymes that degraded the complex structures of wood into simple sugars, such as glucose and cellobiose. In 2016 she published the results of her research on its ability to switch to a yeast-like growth. Understanding this process would be important to the potential use of this fungi in industrial processes.

In the latest study, MSc student CJ Borstlap worked with Dr Heinrich Volschenk, an expert molecular biologist, and Dr Riaan de Witt from the Centre for Bioinformatics and Computational Biology at SU, to produce the first draft genome sequence of *C. pulveracea*. With a genome size of 30 million nucleotides and 10 053 genes, this was no easy task. Genes responsible for the wood-degrading character of the fungus were identified, but the next step is to understand the mechanisms on a molecular level.

"With the genetic blueprint now available, we can study the network of genes and proteins the fungus employs to convert wood and other similar renewable resources into more valuable products," explains Dr Volschenk.

The sequence data for *C. pulveracea* have been deposited at the DNA Data Bank of Japan (DDBJ), the European Nucleotide Archive (ENA) at Cambridge, and GenBank in the United States, and is freely available to all researchers in this field. More information is available online at: https://mra.asm.org/content/8/1/e01429-18.

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