

Researchers barcode DNA of 6,000 fungi species in Venice museum

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Matteo Garbelotto of UC Berkeley prepares a fungal sample from the Venice Museum of Natural History to send to his lab for sequencing and analysis. (Photos courtesy of the Musei Civici Veneziani Photo Archive)

In the storerooms of a Venice, Italy, museum, a University of California, Berkeley, scholar and Italian experts are at work on a rare collection, but the objects aren't Renaissance paintings or the art of ancient glassblowers. Instead, the team is collecting samples from the largest and best preserved collection of fungi in Italy to create an unprecedented DNA database.

These 28,000 samples of fungi that represent 6,000 species - many of which are quite rare - are housed at the Venice Museum of Natural

History, a partner with UC Berkeley for this ambitious project. The collection also is one of the largest in Europe.

The project was publicly announced in Italy today (Wednesday, Dec. 13) at the prestigious Venetian Institute of Sciences, Letters and Arts.

"We are building up a huge molecular database that will be available to the entire scientific community," said Matteo Garbelotto, UC Berkeley adjunct associate professor of ecosystem sciences and principal investigator of the project. "In addition to aiding research on the productivity of forests and agricultural ecosystems, this database will greatly aid the diagnosis of plant diseases."

Fungi are a kingdom of organisms that include yeasts, mushrooms and mold. They are essential to most terrestrial ecosystems, channeling nutrients in the soil and making them available for the growth of plants, including trees and agricultural crops. "Without fungi, there would be no forests," Garbelotto pointed out.

A large number of fungi are also plant pathogens and cause serious diseases of crops and trees, especially when transported to new areas of the world through the global trade of goods and movement of people. In addition, some species of fungi can lead to human illness, including pneumonia, skin infections, allergies and asthma.

Garbelotto is perhaps best known for his work in the identification of *Phytophthora ramorum*, the fungus-like plant pathogen that made its way from Europe to the United States. The pathogen is responsible for sudden oak death, the disease that has caused widespread dieback of tanoaks and coast live oaks in California and southwest Oregon.

"In the case of exotic plant diseases, DNA information may be used, as it is in criminal forensics, to identify possible culprits and to understand

how they were introduced," said Garbelotto. "This provides governments with pivotal information needed to avoid repeated introductions of pathogens."

Garbelotto is working with Italian mycologist Giovanni Robich and Luca Mizzan, curator of Marine Biology at the Venice Museum of Natural History, to sort through the samples in the museum, which are being sent to Garbelotto's lab at UC Berkeley for DNA sequencing and analysis.

The Venice Natural History Museum is part of the Musei Civici Veneziani, a network of 11 museums in Venice. It is housed in the Fontego dei Turchi, a Byzantine-style palace on the Grand Canal that dates back to the 12th century. Before it was established as a museum in 1923, it had served as a trading depot for Turkish merchants.

"Often museums are seen as places where people just go and see things," said Garbelotto, who is doing this work during a sabbatical leave from UC Berkeley. "This shows that museums are actually involved in cutting-edge research. Providing a database of this scope is pretty novel."

Museum curator Mizzan said the museum's vast collection of fungi got a kick start when the Venice Society of Mycology formed in the late 1980s to monitor the mycological flora in the Lagoon of Venice and surrounding areas. The collected samples represented over 1,200 species of fungi and formed the foundation of the museum's present collection.

Garbelotto noted that the relatively young age of the samples has been critical to obtaining good quality tissue for DNA analysis. The samples come from throughout Europe, with a significant number representing species found elsewhere in the world.

Rather than sequencing the entire genome of each species, the researchers are focusing on a non-coding region of the ribosomal DNA

that is known to be unique in each species. The length of the region varies from around 450 base pairs to 900 base pairs, depending upon the taxa from which it is sampled.

"If you're going to cross-compare species, you've got to amplify the same region," said Sarah Bergemann, the post-doctoral researcher in ecosystem science who is heading the lab analysis work at UC Berkeley. Bergemann is working with Amy Smith, staff research associate at Garbelotto's lab, to process the samples Garbelotto sends from Italy.

"This will be important for people who study the evolutionary characteristics of fungi," said Bergemann. "They'll be able to use our database for cross comparisons. It's also useful for people who study species distribution. For example, if you want to figure out how some species are related to one another, and you know something about their taxonomy, you can go back to their DNA to see if the morphological characteristics match their molecular code."

Without the DNA fingerprint, researchers traditionally need to wait for fungi to fruit or mushroom to identify them. "This can be very limiting because mushrooms are only produced seasonally, with some species only fruiting once every several years," said Garbelotto. "The database we are creating will allow people to identify the fungi present in plants, in the soil and in the air at any time."

The project, which began in April, is expected to be completed by the end of 2007. "We do not know of any similar project in Europe, at least of this dimension," said Enrico Ratti, the museum's scientific director.

"The importance of this project is in the cooperation between different subjects, namely private collectors, a private association, a public municipal museum and a foreign university," said Giandomenico Romanelli, director of the Musei Civici Veneziani. "We think that this is

an exemplar model, to be followed in subsequent projects. Furthermore, in our philosophy, natural science collections are public goods that everybody belonging to the scientific community should be able to take advantage of."

Source: UC Berkeley

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