



AMERICAN MUSEUM OF NATURAL HISTORY

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ANCIENT AMBER PRESERVES 52-MILLION-YEAR-OLD BIOLOGICAL PARTNERSHIP FOSSIL PROVIDES EVIDENCE OF EARLY SYMBIOSIS BETWEEN FUNGI AND TROPICAL TREES

Preserved for 52 million years in a piece of Indian amber the size of a walnut, a rare fossil discovered by an international team of scientists from the United States, Germany, and India documents a biological partnership that makes the survival of most terrestrial plants possible.

This long-standing symbiotic relationship between soil fungi and plant roots is called mycorrhizae. With fine thread-like cells, the fungus increases the root surface for the plant, enabling the host plant to access more nutrients. In return, the fungus receives energy from the plant in the form of sugars. This symbiosis also has been shown to enhance a plant's resistance to pathogens and the effects of drought.

"Mycorrhizal relationships are believed to have arisen more than 400 million years ago, as plants began to colonize terrestrial habitats," said Paul Nascimbene of the American Museum of Natural History's Division of Invertebrate Zoology. "They are seen as a key innovation in the evolution of vascular plants."

There are two primary types of mycorrhizae: endomycorrhizae, found in more than 80 percent of all plant species studied, and ectomycorrhizae, which occurs in roughly 10 percent of plant species.

Nascimbene is part of a research team led by Alexander Schmidt from Göttingen University in Germany that has discovered the first fossil ectomycorrhizae associated with flowering plants. Details about the fossil, which was found in a piece of Indian amber and was formed just 13 million years after the demise of dinosaurs, are published in the December issue of the journal *New Phytologist*. The fossil inclusions show various stages of development and reveal a variety of morphological details.

"Mycorrhizae are extremely rare in the fossil record—in fact, only one other fossil ectomycorrhiza has ever been found," said Schmidt. "The Indian amber containing the fossil was produced by the dominant trees of an early tropical rain forest."

Based on the amber's very specific chemistry, as well as on analyses of pollen and fossil wood found in association with the amber, the researchers determined that the tree that produced the

resin is likely a member of the dipterocarp family. These are the prevalent trees in Southeast Asia's rainforests today.

The collaboration between paleontologists from the University of Göttingen, the American Museum of Natural History, and the University of Lucknow (India) made detailed study of the fossils possible.

“Unlike most other ambers, the Indian amber’s unique chemical properties allow it to be dissolved easily in organic solvents,” said Christina Beimforde, a specialist in fossil fungi at Göttingen. “Thus, we were able to extract one of the ectomycorrhiza from the amber and perform ultra-structural analysis using a scanning electron microscope. In this way, we examined the fossil mycorrhizae in as much detail as we can examine living specimens today.”

The researchers also detected melanin, a black pigment, in the ectomycorrhiza. It is the first time that melanin has been found in a fossil fungus or in amber.

The discovery of 52-million-year-old mycorrhizae illustrates the stability of terrestrial ecosystems, said Nascimbene, and “has important implications for the health and survival of today’s forests and other continental biomes.”

American Museum of Natural History (amnh.org)

The American Museum of Natural History, founded in 1869, is one of the world’s preeminent scientific, educational, and cultural institutions. The Museum encompasses 45 permanent exhibition halls and galleries for temporary exhibitions, the Rose Center for Earth and Space with the Hayden Planetarium, state-of-the-art research laboratories and five active research divisions that support more than 200 scientists in addition to one of the largest natural history libraries in the Western Hemisphere and a permanent collection of more than 32 million specimens and cultural artifacts. Through its Richard Gilder Graduate School, it is the first American museum authorized to grant the Ph.D. degree. In 2012, the Museum will begin offering a pilot Master of Arts in Teaching with a specialization in earth science. Approximately 5 million visitors from around the world came to the Museum last year, and its exhibitions and Space Shows can be seen in venues on five continents. The Museum’s website and growing collection of apps for mobile devices extend its collections, exhibitions, and educational programs to millions more beyond its walls. Visit amnh.org for more information.

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