Better together: Bacterial endosymbionts are essential for the reproduction of a fungus

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Endosymbiotic relationships—in which one organism lives within another—are striking examples of mutualism, and can often significantly shape the biology of the participant species. In new findings that highlight the extent to which a host organism can become dependent on its internal symbiont, researchers have identified a case in which the reproduction of a fungus has become dependent on bacteria that live within its cytoplasm.

The findings, which appear online in the journal *Current Biology* on April 5th, are reported by Laila Partida and Christian Hertweck from the Leibniz Institute for Natural Product Research and Infection Biology in Jena, Germany.

The particular partnership under study is the symbiosis of the fungus Rhizopus microsporus and Burkholderia bacteria that live within its cells. The two species effectively team up to break down young rice plants for their nutrients, causing a plant disease known as rice seedling blight. Past work from the research group had revealed that the Burkholderia bacteria play a critical role in the virulence of the fungus against rice seedlings: The bacteria produce a plant poison known as rhizoxin, which has been shown to be the causative agent in rice seedling blight.

The researchers now report a second, striking benefit conferred on the fungus by its intracellular symbiont.
When the bacteria are eliminated from the fungus with antibiotic

treatment, the fungal cells are no longer able to form spores, suggesting that the bacterial symbiont is in fact required for this mode of fungal reproduction. Spore formation in fungi is a universal process that allows the rapid distribution of fungal cells. The new findings appear to represent the first known case in which spore formation—also known as vegetative reproduction—depends on the presence of another organism.

The researchers found that when both organisms were brought together to re-establish the symbiosis, sporulation was restored in the fungus.

In collaboration with researchers at the Leibniz Institute for Age Research, Jena, the team also made progress in understanding how the endosymbiotic bacteria influence reproduction by their host. Using a laser gun to introduce Burkholderia that had been specially labeled with a marker known as green fluorescent protein, the researchers were able to detect the bacteria within both mycelium—the vegetative portion of the fungus—and fungal spores.

On the basis of their findings, the authors conclude that the symbiont-dependent spore formation they observe is a means to maintain the symbiosis between the two species. Although the fungus has lost control over its reproduction, the endofungal bacteria in return provide a highly potent toxin for defending the habitat and accessing nutrients from decaying plants.

Source: Cell Press

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