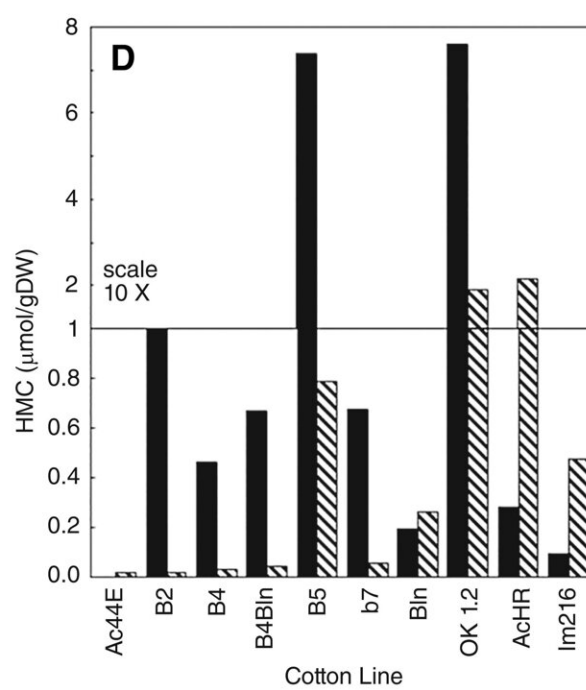
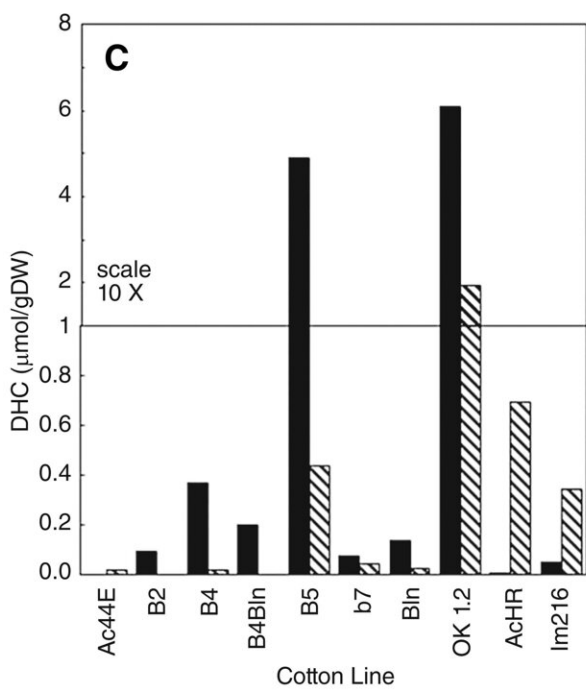
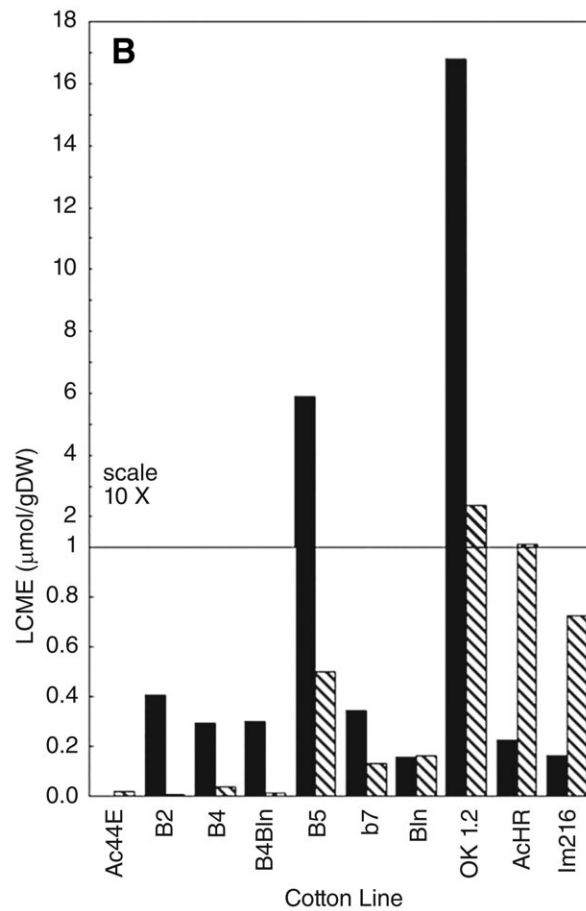
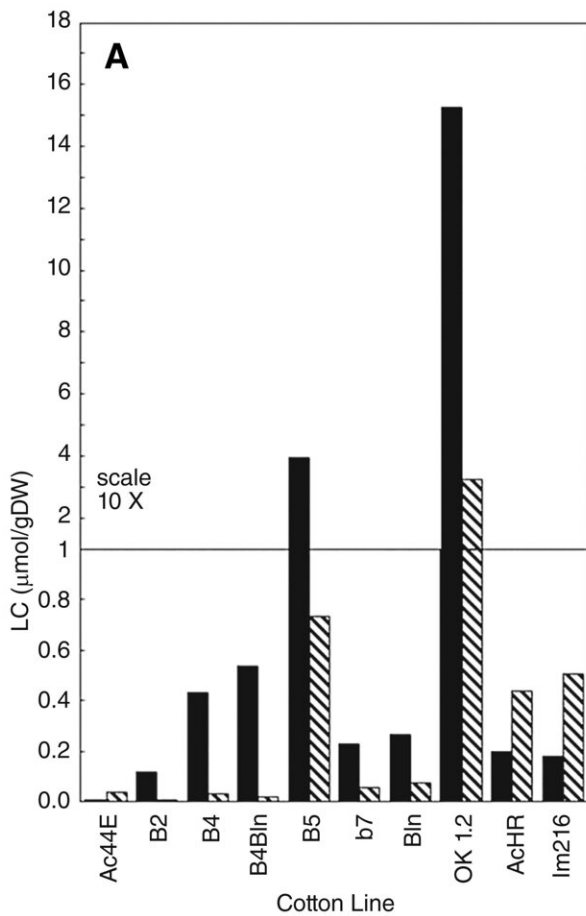


# Gene grants powerful resistance to resurging plant disease

August 7 2023

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Accumulation of phytoalexins in 10 upland cotton lines, averaged over days four, six, and eight postinoculation with approximately  $3 \times 10^6$  CFU ml<sup>-1</sup> *Xanthomonas citri* subsp. *malvacearum* race 1 strain 3631. Black bars are experiment 1, hatched bars are experiment 2. Note the change in y-axis scale in the upper part of each graph. The near-isogenic lines in the widely susceptible Ac44E background are indicated in the figure by their respective B-gene complements. The other lines, OK1.2, AcHR, and Im216, have multiple resistance genes and are described in the Materials and Methods section. A, Lacinilene C (LC); B, lacinilene C 7-methyl ether (LCME); C, 2,7-dihydroxycadalene (DHC); and D, 2-hydroxy-7-methoxycadalene (HMC). Phytoalexins were undetectable in mock-inoculated leaves in 77 of 80 determinations. The other three instances occurred in experiment 1: averaged over days 6 and 10 postinoculation, LC in Acb<sub>7</sub> was 0.004 μmol (g DW)<sup>-1</sup>; and LCME in Acb<sub>7</sub> and AcHR was 0.003 and 0.001 μmol (g DW)<sup>-1</sup>, respectively. All of the bars for inoculated leaves are greater than those mock-inoculated levels except for Ac44E (all four phytoalexins in experiment 1), AcB<sub>2</sub> (LC and DHC in experiment 2), and AcB<sub>4</sub>B<sub>1n</sub> (DHC in experiment 2). Credit: *Phytopathology* (2023). DOI: 10.1094/PHYTO-08-22-0310-FI

While wrapping oneself in 100% Egyptian cotton bedsheets is a delightful luxury on a warm summer night, cotton provides much more than breathable, soft fabric. In addition to textiles, the cotton plant is grown for food, fuel, and daily-use consumer products—such as coffee filters, currency, and moisturizers. However, a resurging plant disease called bacterial blight is currently threatening cotton production worldwide.

Bacterial blight is best controlled through natural, [genetic resistance](#). Although several genes for [natural resistance](#) to bacterial blight of [cotton](#) were discovered in northeast Africa during the mid-twentieth century, one of these genes, found in Egyptian cotton, had been overlooked until a team of researchers led by Margaret Essenberg from Oklahoma State University began studying the gene.

One of their recent studies, published in *Phytopathology*, unveiled that gene B<sub>5</sub> confers powerful [resistance](#) to bacterial blight.

Essenberg and colleagues observed puzzling behavior from gene B<sub>5</sub> after it was crossed into the DNA of upland cotton—a variety used in most clothing fabrics—as it did not appear to follow typical Mendelian genetics. Further investigation revealed an explanation for this peculiarity: upland cotton (AcB<sub>5</sub>) appears to carry gene B<sub>5</sub> at two locations in its genome versus the typical single location.

Under Oklahoma field conditions, the gene at either location enabled strong resistance to bacterial blight. In the lab, AcB<sub>5</sub> exhibited resistance to the predominant and widely virulent strain of the disease's causal pathogen, race 18, in addition to nine other pathogen races.

These findings have positive implications for bacterial blight resistance in agriculture. "Natural, heritable [disease resistance](#) is an economical and environmentally safe means of maintaining plant health," corresponding author Melanie Bayles explains. "Resistance genes trigger synthesis of natural defense chemicals at sites of infection. AcB<sub>5</sub> cotton is a champion in this activity; it accumulated at least ten-fold more defense chemicals than cotton lines with four other single resistance genes."

Because pathogens often evolve to overcome such resistance, relying only on a single gene for disease resistance is precarious. The researchers propose that plant breeders combine this valuable B<sub>5</sub> gene with other strong, broadly specific genes, such as B<sub>12</sub>, to develop durable resistance to bacterial blight.

In addition to plant breeding, Bayles states that this research can benefit disciplines such as molecular plant-microbe interactions and phytochemistry, since the "[signal transduction pathways](#) of five different major [genes](#) for bacterial disease resistance in cotton are shown to lead

in part to production of the same set of defense chemicals." AcB<sub>5</sub> is available for other researchers to use, along with a near-isogenic susceptible parent line.

Essenberg and colleagues' new, quick method for estimating amounts of defense chemicals in cotton plants offers a "blight bulb" idea for improving resistance to this prevalent disease.

**More information:** Margaret Essenberg et al, Gene B5 in Cotton Confers High and Broad Resistance to Bacterial Blight and Conditions High Amounts of Sesquiterpenoid Phytoalexins, *Phytopathology* (2023). [DOI: 10.1094/PHYTO-08-22-0310-FI](https://doi.org/10.1094/PHYTO-08-22-0310-FI)

Provided by American Phytopathological Society

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