Chemicals in smoke help plants grow sturdier, study shows

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When fires rage through forests, they often char acres upon acres of plant life and scar a landscape for years to come. Some plants have learned to use this destructive force to their advantage -- moving into competitors' now-empty territory or producing seeds that burst open from the heat.

Now researchers have identified another way in which widespread flames benefit some fire-following plant species: A family of chemicals in the smoke makes the plants hypersensitive to lower, altered light levels, triggering them to grow thicker, sturdier stems than they otherwise would have.

The findings were published online Monday in Proceedings of the National Academy of Sciences.

"People have known for a long time that there's something (in smoke) that induces seed germination ... but it's only in the last five years or so that anybody has been able to isolate a compound that works," said study editor Winslow Briggs, a biochemist at the Carnegie Institution for Science at Stanford University.

In 2004, researchers established that chemicals known as butanolides -- now named "karrikins" after karrik, the local Aboriginal word for smoke -- were inducing fire-responsive plants to germinate in the wake of a fire.

In the latest study, researchers identified precisely what the chemicals do to Arabidopsis thaliana, a common North American weed whose 30,000 genes have been mapped. The scientists found that exposing the plants to karrikins, derived from burning plant cell walls, activated a handful of genes associated with light sensitivity.

Given that the quality of light that reaches a seed below ground changes after a fire -- the protective canopy is burned away, and the soil is blackened, bending the light into redder territory -- the researchers exposed plants to a different spectrum of light and measured whether exposing the plants to karrikins made a difference.

"If you grow plants in low light, they generally grow tall and spindly because they're searching out for more light, but they're less robust," said lead author Steven M. Smith, a molecular biologist at the University of Western Australia.

But when exposed to karrikins, the first stems that the plants grew were 25 percent to 30 percent shorter than their unexposed counterparts and the first leaves that emerged were about 50 percent larger and more robust, Smith said.

The findings could have implications for both plant recovery after a fire or for commercial farmers, said Ian Thomas Baldwin, founder of the Max Planck Institute for Chemical Ecology, a renowned research institution in Germany.

With smoke-derived technology, farmers could plant seeds, induce weeds to grow before the seeds sprouted and kill off all the weeds in the ground. They could then use karrikins to tell the crops to grow once the fields were clear, said Baldwin, who was not involved in the study.

"It would give you another tool in the toolbox to grow a weed-free crop

without having to use poison," Baldwin said.