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Smoke in the water: Understanding the effects of smoke compounds on seed germination

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Although seemingly destructive, wildfires help to maintain biodiversity and are an important element of many ecosystems throughout the world. Not only do fires discourage non-native and invasive species from becoming established, but the quick release of nutrients, heat, and compounds found in ash and smoke play an important role in the life cycle of the native flora. For plants that are adapted to ecosystems where fire is a regular occurrence—such as savannas, grasslands, and coniferous forests—exposure to fire may initiate seed germination or enhance plant growth.

Recent research has focused on the effects of smoke. As plant tissue is burned, numerous compounds are released, some of which have been found to break seed dormancy and stimulate germination. In a new study published in the March issue of *Applications in Plant Sciences*, scientists at Eastern Illinois University have developed a novel system to produce smoke solutions to further investigate the importance of smoke compounds such as butenolides and cyanohydrins in seed germination and seedling growth.

"Because many of the identified compounds are known to be water soluble, using a smoke solution is a convenient alternative to direct fumigation of seeds," explains Dr. Janice Coons, lead author of the study.

The new system utilizes a bee smoker, heater hose, and water aspirator. Water-soluble compounds are dissolved by bubbling smoke through water contained in a flask. This setup is inexpensive and much more compact than previous systems, allowing for the production of smaller volumes of smoke solution within a small space, such as a fume hood.

This new apparatus increases the concentration of smoke compounds in the solution and allows for greater control of variables. For example, different species of plants contain different compounds, which may have different effects on seed germination. "Native species often require special conditions to break seed dormancy," explains Coons. "This new system allows researchers to produce smoke solutions from any plant species they wish. For instance, it may be advantageous to use species from the specific ecosystem under study when creating the solutions."

In addition, commercially available smoke solutions often contain seed germination enhancers such as gibberellic acid, which may confound results. Solutions made using the method described by Coons and colleagues, on the other hand, provide researchers with the means to distinguish the effects of smoke compounds from other additives.

"This system can be constructed in a relatively small space and will allow future researchers to produce smoke solutions from a wide range of plant species found in the habitats they are investigating," says Coons. "It is relatively inexpensive and allows researchers a high level of control over how their smoke solutions are created so that they can be reproduced."

More information: *Applications in Plant Sciences* DOI: 10.3732/apps.1300097