



PRESS RELEASE (2025/10/16)

Manchurian walnut tree holds key to eco-friendly weed control

The discovery of 2Z-decaprenol, which disrupts weed growth on a molecular level, could pave the way for a new class of sustainable herbicides.

Fukuoka, Japan—In the search for eco-friendly alternatives to synthetic herbicides, researchers from Kyushu University, Japan, have identified a potent, weed-inhibiting compound in the leaves of the Manchurian walnut tree (*Juglans mandshurica* Maxim.). The discovery of the compound, 2Z-decaprenol, and its unique mode of action on plants could lead to the development of more sustainable herbicides. The study was conducted in collaboration with researchers from Juntendo University in Japan and Chulalongkorn University in Thailand and was published in the [*Journal of Agricultural and Food Chemistry*](#).

"This research was inspired by an observation from our former professor, who noticed that there were areas around some trees where other plants did not grow," explains Assistant Professor [Poomraphie Nuntawong](#) from Kyushu University's [Faculty of Pharmaceutical Sciences](#) and the first author of the study. "This sparked our curiosity into allelopathy, the phenomenon where plants release chemicals, known as allelochemicals, to suppress competitors."

In Japan, one naturally abundant and allelopathic tree is the Manchurian walnut, making it a promising candidate as a local source for an eco-friendly herbicide. For many species in the walnut genus (*Juglans*), a chemical called juglone has been widely recognized as the primary allelochemical, but whether this chemical was responsible for the Manchurian walnut's allelopathic effects was not yet known.

To investigate this, the researchers developed a soil-based bioassay designed to simulate the natural process of a leaf falling onto the ground and releasing its chemical contents into the soil. "Many traditional lab assays don't include soil, which can absorb or break down compounds, altering their effectiveness," explains Nuntawong. "We realized that to find the active compounds that work in nature, we needed a model that acts like nature. This is particularly important for compounds like juglone, which are known to degrade in soil."

In their model, a filter paper treated with leaf extracts was placed on top of a soil layer, mimicking a fallen leaf. They then embarked on a process called bioassay-guided fractionation, which involved separating the crude extract from the walnut leaves into distinct chemical groups and repeatedly testing each group's ability to inhibit the growth of tobacco seedlings, a plant chosen for its reliable germination rate.

The team observed that the most potent chemical group—the nonpolar n-hexane fraction—did not contain juglone, while the chloroform fraction that contained juglone showed a smaller inhibitory effect on tobacco seedling growth. Moreover, testing juglone alone based on its natural concentration in the leaves did not impact the tobacco seedling's weight. This suggested to the research team that an alternative, more potent compound was responsible for the Manchurian walnut's allelopathic effects.

After six successive rounds of purification and testing, the team isolated the single compound responsible for the most potent activity, 2Z-decaprenol, marking the first time this compound has been reported as an allelochemical. When tested, 2Z-decaprenol significantly inhibited the growth of the tobacco seedlings, causing reduced weight and a distinctive curling of the roots from the filter paper.

To see how 2Z-decaprenol operates at the molecular level, the team analyzed the genetic activity in the model plant *Arabidopsis thaliana* after treatment. They discovered that 2Z-decaprenol forced the plant to activate some defenses, such as producing protective chemicals and reinforcing its physical structure. Yet at the same time, the compound crippled other essential pathways the plant needs to manage stress and mount an effective immune response, effectively stopping the plant from growing.

Although the discovery of 2Z-decaprenol's growth-inhibiting mechanism opens a new avenue for bioherbicide development, the team emphasizes that their research is still at its foundational stage.

"While these findings are promising, this is the first step on a long path," concludes senior author Associate Professor [Seiichi Sakamoto](#), also from the Faculty of Pharmaceutical Sciences. "To develop 2Z-decaprenol into a viable bioherbicide, we must conduct extensive safety and toxicity testing for humans and animals, further clarify its precise mechanism, and overcome challenges in producing the compound on a large scale. Our ultimate goal is to continue searching for potent, biodegradable compounds from nature that can contribute to a more sustainable future for agriculture."

(Written by Science Communicator Intern, Ken Eguchi)

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For more information about this research, see, "Allelochemical from Leaves of *Juglans mandshurica* Maxim. And Its Transcriptomic Effects in Plants." Poomraphie Nuntawong, Kosei Ando, Tomofumi Miyamoto, Keisuke Matsuura, Thi Huynh Anh Huynh, Varalee Yodsurang, Satoshi Morimoto, and Seiichi Sakamoto. *Journal of Agricultural and Food Chemistry* 2025, 73, 19527-19538. <https://doi.org/10.1021/acs.jafc.5c08261>

About Kyushu University

Founded in 1911, [Kyushu University](#) is one of Japan's leading research-oriented institutes of higher education, consistently ranking as one of the top ten Japanese universities in the Times Higher Education World University Rankings and the QS World Rankings. The university is one of the seven national universities in Japan, located in Fukuoka, on the island of Kyushu—the most southwestern of Japan's four main islands with a population and land size slightly larger than Belgium. Kyushu U's multiple campuses—home to around 19,000 students and 8000 faculty and staff—are located around Fukuoka City, a coastal metropolis that is frequently ranked among the world's most livable cities and historically known as Japan's gateway to Asia. Through its [VISION 2030](#), Kyushu U will "drive social change with integrative knowledge." By fusing the spectrum of knowledge, from the humanities and arts to engineering and medical sciences, Kyushu U will strengthen its research in the key areas of decarbonization, medicine and health, and environment and food, to tackle society's most pressing issues.



Fig. 1. The Manchurian walnut tree (*Juglans mandshurica* Maxim.) in Kyushu University's herbal garden. Researchers studied its leaf extracts in their search for eco-friendly herbicides.



Fig. 2. Assistant Professor Poomraphie Nuntawong observes the effects of Manchurian walnut leaf extracts on seedling growth.

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