
The coumarin scopoletin behaves as an auxin herbicide on *Arabidopsis* seedlings

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Abstract

Due to the increasing side effects of synthetic herbicides (weed resistance, environmental toxicity, human diseases, etc.) many natural compounds with phytotoxic activities have been already identified and studied to be used as eco-friendly bioherbicides.

Scopoletin is a secondary metabolite belonging to the group of coumarins that can be found in different plant species like tobacco, sunflower, plum tree, *Avena sativa* and others. Although some studies have demonstrated its phytotoxic capacity, no in deep studies have been done to elucidate its mode of action on plant metabolism.

Analysis conducted by light and electron transmission microscopy revealed strong cell and tissue abnormalities at root tip level, such as cell wall malformations, multi-nucleated cells, abnormal nuclei and tissue disorganization. Besides, scopoletin induced reoriented microtubule assembly and ultimate cell death. Most of the effects observed after scopoletin treatment were similar to those observed after 2,4D, an auxin herbicide. Moreover, structural analyses of scopoletin revealed that it perfectly fits into the auxin-binding site of TIR1.

Our results show that scopoletin compromises root development of treated roots by inducing wrong microtubule assembling, mitochondrial membrane depolarization and ultimate cell death, which suggests a multi-mode of action on plant metabolism. Taken together, the results confirm the phytotoxic activity and plant growth regulator profile of scopoletin, whose mode of action on *Arabidopsis* metabolism is similar to auxinic herbicides.

Keywords: mode of action, auxin herbicide, coumarin, microtubule

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