

学位論文要旨
Dissertation Abstract

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学位論文題目 : **Evaluation of Allelopathic Activity and Identification of
Allelopathic Active Substances in Thai Medicinal Plants**
Title of Dissertation (タイ薬用植物におけるアレロパシー活性の評価とアレロ
パシー候補物質の同定)

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Heavy agricultural reliance on synthetic herbicides is having serious impacts on the environment and some herbicides are being restricted in use. The utilization of natural products or the application of natural mechanisms such as allelopathy is considered feasible alternative means. Allelopathy is a natural mechanism in which plants release allelochemicals or secondary metabolites into the surrounding environment which interfere with the growth, development, and reproduction of other organisms nearby. In this direction, taking advantage of the potential allelopathic plants and allelochemicals are gaining attention to minimize the effect of synthetic herbicides and could be acceptable in sustainable agricultural practices.

This research, therefore, has focused to evaluate the potential allelopathic plants and to isolate potent allelochemicals from Thai medicinal plants. Four medicinal plants were used in this research; *Acacia concinna* (Willd.) DC. (Fabaceae), *Elephantopus scaber* L. (Asteraceae), *Caesalpinia mimosoides* (Fabaceae), and *Jatropha podagrica* Hook. (Euphorbiaceae). The aqueous methanol extracts of the pods of *A. concinna*, the whole plants of *E. scaber*, the leaves of *C. mimosoides*, and the leaves of *J. podagrica* showed significant inhibitory effect on the seedling growth of the representative test plants (cress, lettuce, alfalfa, rapeseed, barnyard grass, Italian ryegrass, foxtail fescue, and timothy). The effectiveness of the inhibition was proportional to each extract concentration. The susceptibility to the extract of the test plants was varied in tested species. Comparing the concentration required for 50% growth inhibition (I_{50} values) of all the extracts, the extracts of *A. concinna*, *C. mimosoides*, and *J. podagrica* had

stronger inhibitory activity than those of the extracts of *E. scaber*, with the values in the range between 0.02-2.59, 0.5-8.4, 0.05-13.2, and 5.7-57.6 mg dry weight equivalent extracts/mL, respectively. The inhibitory activities of those plant extracts suggest that the plants may have allelopathic potential and may contain allelopathic substances.

Therefore, aqueous methanol extracts of each medicinal plant were purified through a series of chromatography and bioassay-guided fractionations resulted in the isolation of two inhibitory substances; methyl gallate from the leaf extracts of *C. mimosoides* and 6,7-dimethoxychromone from the leaf extracts of *J. podagrica*. In addition, three unknown growth inhibitory substances were also isolated from the pod extracts of *A. concinna* (one substance), and the whole plant extracts of *E. scaber* (two substances), which these are required to characterize and may have value in weed control in the natural-based system.

Methyl gallate isolated from the leaf extracts of *C. mimosoides* had the inhibitory activity on the growth of cress and barnyard grass. Methyl gallate at 10 mM completely inhibited the cress shoots and inhibited its roots by 4.7% of control growth. At the same concentration, the shoots and roots of barnyard grass were inhibited by 84.2 and 1.7% of control growth, respectively. The I_{50} values of methyl gallate for the growth of cress and barnyard grass ranged from 2.3 to 2.9 mM and 1.5 to 15.1 mM, respectively. These results indicate that methyl gallate may be responsible for *C. mimosoides* allelopathic potential.

6,7-Dimethoxychromone was isolated from the leaf extracts of *J. podagrica*. 6,7-Dimethoxychromone significantly inhibited the shoots and roots of cress at concentrations greater than 0.3 mM. The growth inhibition was increased with increasing substance concentration. The I_{50} values of 6,7-dimethoxychromone for the shoot and root growth of cress were 0.95 and 0.83 mM, respectively. The inhibitory activity against the seedling growth of cress indicates that 6,7-dimethoxychromone may contribute to the allelopathic effects and may be responsible for the allelopathic activity in *J. podagrica*.

In this research, four medicinal plants have shown the inhibitory activity against the growth of representative test plants, indicating that those medicinal plants may contain allelopathic substances. Five potential inhibitory substances were isolated and those substances also exhibited inhibitory effects on the growth of test plants. Especially, two known substances isolated from *C. mimosoides* and *J. podagrica* may be the main inhibitory substances contributed to the allelopathic activity of *C. mimosoides* and *J. podagrica*. The plant residue of these medicinal plants, their plant extracts and/or its inhibitory substances could, therefore, be utilized as natural sources of bioactive substances and may be potential candidates for the development of bioherbicides.