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学 位 論 文 要 旨
Dissertation Abstract

氏名： **KAWSAR HOSSEN**
Name

学位論文題目：
Title of Dissertation

Allelopathic activity and identification of allelopathic compounds from Bangladeshi medicinal plants for the development of bioherbicides to control weeds
（生物除草剤の開発のためのバングラデシュ産薬用植物のアレロパシーとアレロパシー物質に関する研究）

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To protect our environment from the toxic effect of herbicides, it is necessary to reduce the application of synthetic herbicides for controlling weeds in crop fields as well as to increase the use of natural herbicides produced from plant sources. Allelopathic compounds obtained from plant species have gained attention as an alternate biological method for managing weeds. In this study, three species of medicinal plants such as *Acacia catechu* (L.f.) Willd, *Albizia richardiana* (Voigt.) King & Prain and *Elaeocarpus floribundus* Blume plants were used to evaluate their allelopathic activity, and to isolate and identify allelopathic compounds.

The aqueous methanol extracts of *Acacia catechu* significantly suppressed the seedling growth of six test plants such as alfalfa, cress, lettuce, barnyard grass, Italian ryegrass, and timothy. The extracts inhibited the six test plants in a concentration-dependent manner. The seedlings of the test species were completely inhibited at the concentration of 0.3 g of dry weight equivalent extract/mL, except the shoot growth of barnyard grass. Concentrations needed for 50% growth inhibition (I_{50} values) ranged from 0.004–0.043 and 0.003–0.019 g dry weight equivalent extract/mL for shoot and root, respectively. The inhibitory effects of the extracts of *A. catechu* suggest that the plant may contain allelopathic potential and may be a potential candidate for the development of an eco-friendly bioherbicide.

Aqueous methanolic extracts of *Albizia richardiana* plant significantly restricted the seedling growth of the examined plants alfalfa, lettuce cress, timothy, barnyard grass,

and Italian ryegrass in a species- and concentration-dependent manner. Five allelopathic compounds were isolated using several purification steps and characterized through spectral analysis as dehydrovomifoliol, loliolide, 4,5-dihydrovomifoliol, 3-hydroxy-5α,6α-epoxy-β-ionone,and3-(2-hydroxyethyl)-2,4,4-trimethyl-2cyclohexen-1-one. These five active compounds significantly suppressed the seedling growth of cress in concentration-dependent way. The concentration of the compounds required for 50% growth reduction (I_{50} value) of the cress seedlings ranged between 0.025 to 3.163 mM. The results suggest that these five phytotoxic compounds might contribute to the allelopathic potential of *Albizia richardiana* plant.

Another two active compounds were separated from another active fraction of column silica gel and characterized through different chromatographic steps as a novel compound 3-hydroxy-4-oxo-β-dehydroionol, and 3-oxo-α-ionone. They significantly restricted the seedling growth of cress and timothy. The required concentration for 50% reduction in the growth (I_{50} values) of the cress and timothy seedlings varied from 0.063 to 0.141 mM for 3-hydroxy-4-oxo-β-dehydroionol and 1.059 to 1.616 mM for 3-oxo-α-ionone, respectively. The results indicate that these two allelopathic compounds also may be responsible for the phytotoxicity of *Albizia richardiana* leaves.

The aqueous methanol extracts of *Elaeocarpus floribundus* leaves significantly suppressed the growth of the tested species (cress and barnyard grass) in a dose- and species-dependent way. The three most active allelopathic substances were isolated via several chromatographic steps and characterized as (3*R*)-3-hydroxy-β-ionone, *cis*-3-hydroxy-α-ionone, and loliolide. These three substances significantly limited the seedling growth of cress which was concentration dependent. The concentrations of the compounds required for 50% growth inhibition (I_{50} value) of the cress seedlings were in the range of 0.13–0.53 mM. The findings indicate that all three allelopathic substances contribute to the allelopathic activity of *Elaeocarpus floribundus*.

In this study, three species of medicinal plant have displayed the growth limitation potential against the seedling growth of examined plant species, suggesting that the medicinal plant species may possess allelopathic compounds. Ten potent growth inhibitory compounds were identified from the leaf extracts of *Albizia richardiana* and *Elaeocarpus floribundus*, and the compounds also shown inhibitory activity on the seedling growth of examine species. Therefore, the results of this research may be able to play a vital role for the development of bioherbicides to control weeds and also save the environment.