

学位論文要旨 Dissertation Abstract

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学位論文題目 : Allelopathic Potential and Allelopathic Substances from Leaves
Title of Dissertation of Three Tree Species
(3種の樹木の葉のアレロパシー活性及びアレロパシー物質)

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Litchi (*Litchi chinensis* Sonn.), cannon-ball (*Couroupita guianensis* Aubl.) and mango (*Mangifera indica* L.) have been drawn the attention to many researchers because of their myriad of pharmacological activities. However, a few reports on the allelopathic properties of these species have been studied. Therefore, this research aimed to explore the allelopathic potential and allelopathic active substances in leaves of these species.

Seed germination of all test plants were significantly inhibited by the extracts obtained from litchi, cannon-ball and mango leaves at concentrations ≥ 0.01 g dry weight (DW) equivalent extract mL^{-1} . The extracts of litchi and cannon-ball leaves completely inhibited germination of lettuce and significantly delayed germination of barnyard grass at the concentration of 0.1 g DW equivalent extract mL^{-1} . At the same concentration, extracts obtained from three mango cultivars (Khirshapat, Himsagor and Sinduri) showed a significant delayed or/and complete inhibition of germination of all test plants except for Sinduri extracts on barnyard grass.

The hypocotyl/coleoptile and root growth of all test plants were significantly inhibited by extracts obtained from three species at concentrations ≥ 0.01 g DW equivalent extract mL^{-1} . The inhibitory activities were dependent on test plants and extracts concentration. The extracts obtained from litchi leaves completely inhibited hypocotyl growth of cress, lettuce and alfalfa, and root growth of all test plants, while 87, 90 and 62% coleoptile growth inhibition was found on timothy, Italian ryegrass and barnyard grass, respectively at the concentration of 0.1 g DW equivalent extract mL^{-1} . At the same concentration, the hypocotyl/coleoptile and root growth of all test plants were inhibited by leaf extracts of cannon-ball to more than 90%, except for hypocotyl/coleoptile growth of alfalfa and barnyard grass. On the other hand, three mango extracts showed more than 70% hypocotyl/coleoptile and root growth inhibition of all test plants except barnyard grass at the concentration of 0.1 g DW equivalent

extract mL^{-1} . The concentration required for 50% growth inhibition (I_{50}) for hypocotyl/coleoptile and root growth of all test plants ranged from 0.002-0.079, 0.001-0.010 and 0.003-0.103 g DW equivalent extract mL^{-1} for litchi, cannon-ball and mango, respectively.

As no significant differences among three mango cultivars were found for their inhibitory activities on germination and growth of hypocotyl/coleoptile as well as root of all test plants, all of them could be candidates for isolation and identification of allelopathic substances. Therefore, further isolation and identification of these substances from the extracts of Khirshapat leaves was first proceeded. The extracts of Khirshapat leaves was purified by several chromatographic separations through bioassay-directed fractionation, and an allelopathically active substance was identified by spectral data as methyl-3,4,5-trihydroxybenzoate (methyl gallate). The inhibitory effects on seedling growth of garden cress and foxtail fescue were observed at concentrations ≥ 1 mM of methyl gallate. The I_{50} values of methyl gallate on garden cress root and hypocotyl were 4.9 and 3.4 mM, respectively, whereas those on foxtail fescue root and coleoptile were 1.4 and 10.1 mM, respectively. Comparing I_{50} values, effectiveness of methyl gallate on hypocotyl was 1.4-fold greater than that of root of garden cress and on root was 7.2-fold greater than that of coleoptile of foxtail fescue, respectively. These results indicate that methyl gallate may contribute an important role in allelopathic activities of mango.

Leaves of litchi, cannon-ball and mango inhibited seed germination and seedling growth of different test plants including weeds. These results suggest that these three tree species have allelopathic potential and may possess allelopathic active substances. Therefore, these three species could be candidates for isolation and identification of those active substances to serve as weed inhibiting agents for sustainable crop production. An allelopathic substance was found as methyl gallate in mango leaves and the substance showed inhibitory activities on test plants at concentration dependent manner. However, further isolation and identification of allelopathic active substances from leaves of litchi and cannon-ball species should be investigated for assessing their effects on weeds.