

学位論文要旨 Dissertation Abstract

氏名 : Md Mahfuzur Rob
Name

学位論文題目 : **Study on Allelopathic Potential and Allelopathic Substances of Two *Garcinia* Species and *Schumannianthus dichotomus* from Bangladesh**
Title of Dissertation (バングラディッシュ産のフクギ属植物2種と*Schumannianthus dichotomus*のアレロパシー活性とアレロパシー候補物質に関する研究)

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Allelopathy is an interference mechanism in which plants or their dead parts release biochemicals known as allelochemicals that impose negative effects against the associated plants. Allelopathic potential of a plant extract or allelochemical is typically assessed by their ability to cause growth inhibitory effect on recipient plant species. Exploitation of allelopathic potential of different plant materials and their identified active allelopathic substances (allelochemicals) can be considered as an alternative tool in weed management. In fact, some allelochemicals are already being used in environmentally friendly bioherbicides formulation. Therefore, allelopathic plants and allelopathic substances are promising candidates for weed management in sustainable agriculture.

The current research was conducted to evaluate the allelopathic potential of three higher plants from Bangladesh, namely *Garcinia pedunculata*, *Garcinia xanthochymus* and *Schumannianthes dichotomus*. The aqueous methanol extracts of fruit of *G. pedunculata*, the leaves of *G. xanthochymus* and *S. dichotomus* exhibited significant phytotoxic activity against eight test plants including four monocots (barnyard grass, foxtail fescue, Italian ryegrass, and timothy) and four dicots (alfalfa, cress, lettuce and rapeseed) in concentration- and test species-dependent manner suggesting all the extracts of donor plants may have allelopathic potential and may contain allelopathic substances responsible for such activity

Therefore, compounds having phytotoxic activity were isolated using bioassay-directed purifications and identified by using different spectral analysis. Three

phytotoxic compounds were isolated from the leaf extracts of *G. xanthocymus* and identified as garcienone, vanillic acid and methyl phloretate. All the identified compounds significantly inhibited seedling growth of cress at concentration 10 μM , except vanillic acid which required at least 30 μM concentration to affect the seedlings. The rate of inhibition was increased with the increasing of the compounds concentration having I_{50} values of garcienone, vanillic acid and methyl phloretate for cress were 120.5-156.3, 314.7-331.7 and 104.7-113.7 μM , respectively. These results suggest garcienone, vanillic acid and methyl phloretate may contribute to the phytotoxic effect of *G. xanthocymus*.

Another three compounds were isolated from the leaf extracts of *S. dichotomus* and identified as syringic acid, schumannione and methyl syringate. Methyl syringate, schumannione and syringic acid showed significant growth inhibitory effects on the seedling growth of cress at concentration 3, 10 and 30 μM , respectively with the I_{50} values of 31.5-43.2, 114.1-160.9 and 61.3-75.8 μM , respectively. The effect of all these three compounds depended on concentration. The growth inhibitory results of the compounds indicate that methyl syringate, schumannione and syringic acid may play vital role in allelopathic activity of *S. dichotomus*.

Comparing the I_{50} values of all the six identified compounds from *G. xanthochymus* and *S. dichotomus* against cress, methyl syringate showed most growth inhibitory activity with the I_{50} values of 31.5-43.2 μM , while least inhibitory activity was obtained from vanillic acid having those I_{50} values of 314.7-331.7 μM . It is interesting to note that, this is the first report of garcienone and scumannione as they are novel compounds, and existence of methyl phloretate in natural source.

The present study showed that *G. pedunculata*, *G. xanthochymus* and *S. dichotomus* had the significant phytotoxic activity against seedling growth of monocot as well as dicot test plants, which may contribute to their allelopathic potential. To the best of our knowledge, this study is the first to report the allelopathic activity of *G. pedunculata*, *G. xanthochymus* and *S. dichotomus*, and identification of specific compounds responsible for the allelopathic activity of *G. xanthochymus* and *S. dichotomus*. Consequently, these plants have the prospect to utilize their plant residues, plant extracts or the phytotoxic compounds in weed management strategy.