GRAVITY FOR ALLELOPATHY IN PLANTS

Tomita-Yokotani K.[1], Hashimoto H.[1], Fujii Y.[2], Nakamura T.[3], Yamashita M.[4]

[1] University of Tsukuba,
[2] National Institute for Agro-Environmental Sciences,
[3] Japan Women's University,
[4] Institute of Space and Astronautical Science /JAXA

Many diverse life forms have been evolved on the earth. Individual organisms interact each others, and live together under the influence of allelopathy among them. When human society extends its living terrain to outer space, closed ecological system will be synthesized to make environment there livable. Biosynthesis of allelochemicals, their release, transport and sensing mechanism at the recipient organisms, which is associated with allelopathy, are under the influence of gravity in many aspects. Such gravitational action on the allelopathic processes could be ranged from perturbation on biochemical networks in the cells to macroscopic transportation phenomena around the organisms. If gravity is an environmental factor that governs those processes, allelopathy shown at the absence of gravity on either spacecraft or extraterrestrial bodies might differ from the allelopathy on the ground. Another important factor for allelopathy in space application is physical closure of living environment, lack of natural process to decompose allelopathic chemicals, and small scale of the sink for the material circulation in biosphere. Many organisms and ecological system may behave differently in spacecrafts or on outer planets, based on the modified inter-organisms and -species interactions associated with alleopahty. In order to initiate basic study on allelopathy for space application and to know what kind of modification would be shown under microgravity, we conducted pseudo-microgravity experiment using a 3D-clinostat. Biosynthesis, release and sensing process of allelopathic chemicals were examined in details. Velvet bean (*Mucuna pruriens* L.), known to induce strong allelopathic action on many plant species, was examined with lettuce as its pair species. Growth of lettuce seedlings, co-cultured with velvet bean, was analyzed under the 3D-clinorotation, and compared it with growth of the ground control group. The degree of allelopathic suppression on the lettuce root growth was less on the 3D-clinorotation. L-DOPA (L-3,4-dihydroxy-phennylalanine), released from root of velvet bean is the major substance responsible to its allelopathy. The number and growth of adventitious root in velvet bean differed between the clinostated and the control group. We also investigated the effects of gravity on allelopathy induced by volatile substances.