

Closed bio-ecosystems by the systems of organisms

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Various species of living organisms on the earth have evolved for a long time. They are equipped with several important functions affecting each other. Knowledge on these functions and interactions with ecological factors is essential to secure a design of a closed-ecosystem with a limited number of living species under severe environments, such as space and deep sea or desert. This session will discuss biological and technical systems for the establishment of closed systems shown in several research reports. I will introduce this research.

Keywords: Closed bio-ecosystem, Severe environment, Space experiment

Proteins involved in desiccation tolerance of *Nostoc* sp. HK-01

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Nostoc sp. HK-01 is one of terrestrial cyanobacterium having a tolerance to desiccation stress and it has several ability, photosynthesis, nitrogen fixation and usefulness as a food, it is thought that it can be used for bio-chemical circulation in a closed ecosystem, including space.

In this study, we searched for the proteins that play an important role in the desiccation stress response. A study on desiccation tolerance predicted at the time of introduction to a closed bio-ecosystem is necessary. To investigate expression changes of the proteins in *Nostoc* sp. HK-01 cells, the proteins were analyzed by SDS-polyacrylamide gel electrophoresis. In the course of desiccation, an increased level of expression of a certain was detected.

Keywords: cyanobacteria, *Nostoc* sp., desiccation tolerance, stress protein

Production and maintenance of the most useful tree in a closed environment

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Trees can have several important roles; oxygen supply, carbon fixation, materials and functional substances for human especially in closed bio-ecosystems. In general, the genetic background of all productive trees are basically different because of cross ? pollination. We are now screening useful trees and their maintenance techniques using several traditional methods of trees planting. Species of Sakura are originally grown in the Mt. Fuji area, oligotrophic location. We are trying to create the best useful woody plant under closed bio-ecosystems with "Mamezakura", *Prunus incisa* , as a model tree.

Keywords: Closed bio-ecosystems, Tree planting, *Prunus* sp., useful tree

Analysis of filamentous fungal cell wall components to study the existence of endophytes

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Endophyte is an organism that lives inside a plant. Endophytes of the ergot fungus family *Neotyphodium* reproduce by producing seeds, although the life cycle of the endophyte remains unclear. Tall fescue (*Festuca arundinacea*) non-infected and infected with *Neotyphodium* sp. Fe-047 were used as materials in this study. Chitin is a component of the filamentous fungal cell wall. Chitin is decomposed to (GlcNAc)₂ by an enzyme and we analyzed the amount of (GlcNAc)₂ that can be produced. This analysis has advantages compared to the already investigated methods using proteins or genes.

There are 80-90 % of land plants living together with filamentous fungi. The symbiotic relationships change between the plant and endophyte under microgravity conditions. We will discuss the value of this research method for symbiotic relationships between plants and endophytes in an artificial closed bio-ecosystem.

Keywords: endophyte, symbiosis, closed bio-ecosystem

Developing a water source forest conserved in a suburban park into an educational space

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People who still use spring water for paddy fields and daily living know how to cherish the blessings of nature. In contrast, it is difficult for people in the modern age to learn that water from nature is a precious resource, while water resources are of serious global concern.

The aim of the project was to conduct investigations on soil, water quality, aquatic organisms, and vegetation in the water source forest by researchers in respective disciplines and develop it into an educational space to facilitate education for sustainable development. The forest, which is now a source of spring water used for paddy fields, serves as a field to pass on how to grow the soil sustainably in a suburban area to the next generation.

Keywords: Environmental Education