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Exploring the Diversity of Root Phenotypes Using Ethyl Methanesulfonate (EMS)-Induced Mutagenesis in Rice (*Oryza sativa* L.)

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[Introduction]
Plant organs are essential for achieving the high productivity of food crops. They also contribute to the architecture or adaptation of plants to various environmental conditions. Under field conditions, roots are belowground plant organs that serve as the structural support for the plant and mediate the acquisition of nutrient elements and water from the soil throughout the plant's lifecycle. The rooting system of plants has a complex architecture and is well-structured and functionally organized to the extent that each part of the rooting system plays a unique role, going from root growth from the root tip vertically to the root hairs or lateral roots horizontally. Ethyl methanesulfonate (EMS) is widely used as a non-transgenic chemical mutagen to create mutations and gain new genetic makeup for plants. EMS-mediated mutagenesis has proven effective in inducing random mutations in plants, causing changes in the phenotypes of mutants.

[Materials and Methods]
We screened 1597 Youngjin EMS mutant rice lines for their differential root phenotypes. Prior to sowing, seeds of Youngjin EMS mutants and wild type (Youngjin) were soaked for about 72 hours to induce germination. Well-germinated seeds were sown in 50-well trays containing enriched soil with basic nutrients adapted for rice seedling growth. Root phenotypes of Youngjin EMS mutants were evaluated on 21-day-old seedlings compared to the WT. Two rounds of validation were performed on towel paper to select Youngjin EMS lines with stable and differential root phenotypes.

[Results and Discussion]
We identified 95 Youngjin EMS mutant lines with differential root phenotypes (root length, number or abundance, abundance or less of root hairs). The preliminary phenotypic characterization revealed that among the preselected 95 Youngjin EMS lines, 25 exhibited consistent differential root phenotypes with the WT. These lines will be used for a final validation prior to conducting downstream experiments. The selected Youngjin EMS lines will be used as breeding materials with specific root traits to investigate the possible relationship between root development and gas exchange-mediated GHG uptake and release in agriculture.

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