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Impact assessment of cadmium contamination on rice (Oryza sativa L.) seedlings at molecular and population levels using multiple biomarkers

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Assessment of environmental contamination on ecology (plant) at molecular and population levels is important in risk quantification and remediation study. Random amplified polymorphic DNA (RAPD) assay and related other fingerprinting techniques have been employed to detect the genotoxin-induced DNA damage and mutations. This research compared the effects occurring at molecular and population levels in rice seedlings exposed to cadmium (Cd) concentrations of 15˜60 mgĎłLąV1 for eight d with quartz sand culture. Inhibition of root growth and increase of total soluble protein content in root tips of rice seedlings were observed with the increase of Cd concentration. For the RAPD analyses, 12 RAPD primers of 50˜70 % GC content were found to produce unique polymorphic band patterns and subsequently were used to produce a total of 180 bands of 179˜3056 bp in molecular size in the control root tips of rice seedlings. Results produced by these RAPD primers indicate that changes in RAPD profiles of root tips after Cd treatment include modifications in band intensity and gain or loss of bands by comparison with control. The effect of changes was dose-dependent. Genomic template stability compares favourably with the traditional indices such as root growth and soluble protein content. The DNA polymorphisms detected by RAPD analysis can be applied as a suitable biomarker assay for the detection of genotoxic effects of Cd contamination on plants.