same trend that increased firstly at lower dose, both have a small peak at the 50 Gy, the contents of these two pigments are significantly higher than those in the control group. And then they decrease with the increment of dosages. Ionizing radiation is a stress for plants, but the influence has two sides. On one hand, a suitable low dose radiation can stimulate the growth; therefore, the incensement of photosynthetic pigments may be stimulated by the low dose irradiations. However, on the other hand, the capabilities of plants to resist irradiations are limited, when the radiation dosages exceed a certain limit, it can cause harm to plants themselves. So, at the high dose of 200 or 300 Gy, the synthesis of photosynthetic pigments is seriously restrained.

3 - 51 Application of RAPD Technology in Mutation Breeding with Heavy Ion Beam in Sweet Sorghum

Dong Xicun, Li Wenjian, Liu Ruiyuan and Jing Wenjie

Heavy ion beam is expected to increase mutation frequency and mutation spectrum, characterized by a high linear energy transfer (LET) and relative biological effectiveness (RBE)[1]. At present, various mutants induced by heavy ion beam such as florets color and shape mutants in rice (Atsushi, et al., 2010), and a sterile mutant of Verbena hybrida, etc. have been reported[2]. These results are attributed to the rapid misrejoining of a higher fraction of DNA breaks[3]. RAPD (random amplified polymorphic DNA) analysis is useful to clarify the genetic background for such mutants[4]. Sweet sorghum [*Sorghum bicolor* (*L.*) Moench] is a C4 plant characterized by a high photosynthetic efficiency and a high biomass- and sugar-yielding crop[5]. Therefore, sweet sorghum has the potential of becoming a useful energy crop. In order to detect genetic polymorphism, genomic DNA of irradiated by 120, 160, 200, 240 Gy and early-maturity

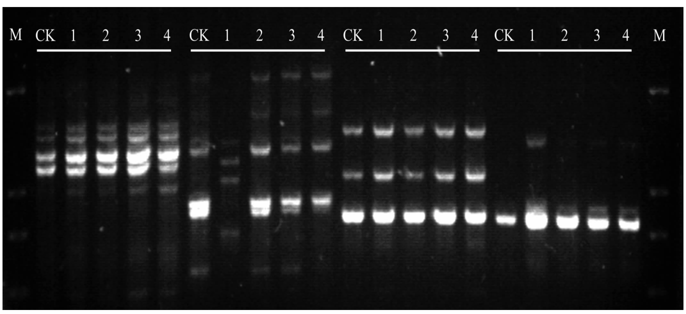

Fig. 1 RAPD patterns of control sweet sorghum plants and plants from seeds irradiated by carbon ion beam by primers S104, S113, S117, and S135. CK means the control. M is DL2000. 1～4 are four plants from seeds irradiated by carbon ion beam with different doses of 120, 160, 200, 240 Gy, respectively.

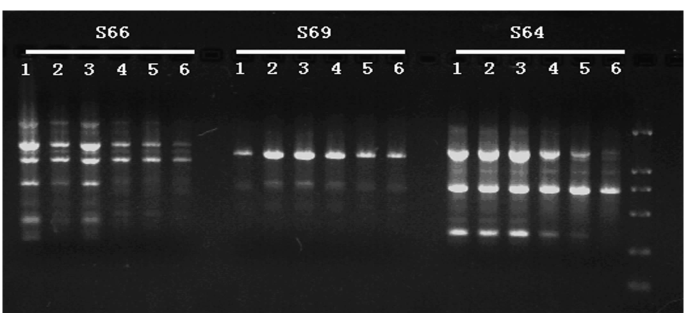

Fig. 2 RAPD pattern of KFJT-CK and KFJT-1 by primers S66, S69, S64. M is DL2000. 1～3 represented KFJT-CK and 4～6 represented KFJT-1. 1～3 and 4～6 represented three replications of KFTJ-CK and KFJT-1 from the same primer, respectively.

mutant were randomly amplified by PCR method, respectively. The results indicated that there was significant difference among different doses (Fig. 1). Further analysis showed that 726 bands were produced by 38 primers in all, among which 86 DNA bands were polymorphic bands with the value being 11.9%.

Similarly, 29 primers were used to amplify genomic DNA of KFJT-CK and KFJT-1, which KFJT-1 was isolated from irradiated progenies of KFJT-CK (Fig. 2). The results revealed that 152 bands were produced from KFJT-1 and KFJT-CK in all, among which 8 DNA bands were polymorphic bands with the value being 5.3%.

Taken together, RAPD technology is an effective method which be used for the detection of DNA damage and mutations and it can quickly detect a large number of genetic polymorphism in sweet sorghum.

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3 - 52 Leaf Variegation Mutant Induced by Carbon Ion Irradiations in *Arabidopsis thaliana*

Yu Lixia, Du Yan, Zhou Libin, Chen Gang, Luo Shanwei and Li Wenjian

Arabidopsis thaliana is an important model plant species for identifying genes and determining their functions, it was widely used in the study of plant genetics, developmental and molecular biology. As a model plant, *Arabidopsis thaliana* has many advantages for research, such as small size, short generation, large number of offspring and relatively small nuclear genome.

Leaf variegation has been known as a recessive genetic character in higher plants. For screening the mutants of leaf variegation, abundant of dry seeds of *Arabidopsis thaliana* (ecotype: Columbia) were irradiated by carbon ions provided by the Heavy Ion Research Facility in Lanzhou (HIRFL) in 2011. A leaf variegation mutant named 352# was isolated from M2 populations. As shown in Fig. 1, the plantlet of this mutant had shorter petioles and compact rosettes comparing with wild type. Not only leaves but also stems of this mutant were all variegated. Moreover, it was interesting that the color of flowers and siliques of mutants 352# were variegated.

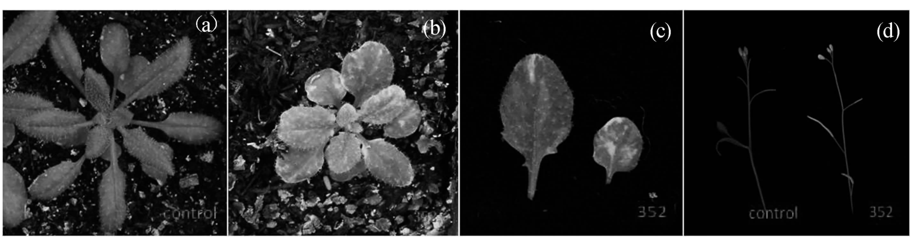

Fig. 1 The phenotype of leaf variegation mutant induced by carbon ion irradiation. (a) wild type; (b) mutant 352#; (c) leaves of mutant 352#; (d) stem and siliques of mutant 352#.

In order to study the molecular mechanism of leaf variegation induced by carbon ions, the method of Map-based cloning was applied to separate the target gene. F2 populations crossed with the ecotype *Landsberg erecta* and mutants 352# were used as the mapping population. The results of rough genetic linkage analysis showed that the target gene was primary located on chromosome Ⅲ. The fine genetic mapping and the function of target gene determination will be performed in the near future.