pared to the control, the root growths in 400 Gy got slower, with the dose increasing, they were inhibited severely even ceased. The measure of root length after 2 weeks had the same result with that in Fig. 3. These results suggested that the reduction of survival rate and root length in alfalfa exposure to carbon ion beams had the dose dependent manner.

3 - 50 Influence of $^{12}C^{6+}$ on Phenotypes and Photosynthetic Pigments of *Lotus Japonicus*

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

As a model legume plant, *Lotus japonicus* has many advantages for legume research. These characteristics contain small plant, large and abundant flowers, easy hand pollination, high seed production, short generation time, easy cultivation, amenable to plant transformation and regenerationfrom tissue culture. At present, a set of genetic resources and tools has rapidly become available. Research on *Lotus japonicus* has greatly contributed to the understanding of both symbioticprocesses, i. e. with *Rhizobium melilotiand* mycorrhiza, making possible the cloning of several keygenes involved in both symbioses. Photosynthesis is the basic substance metabolism and energy metabolism of green plants. It plays an important role in the life-cycle of plants. Experiments aimed to investigate the effect of carbon ions on the phenotypic variation and photosynthetic pigments contents of *Lotus japonicus* have been performed at HIRFL-CSR.

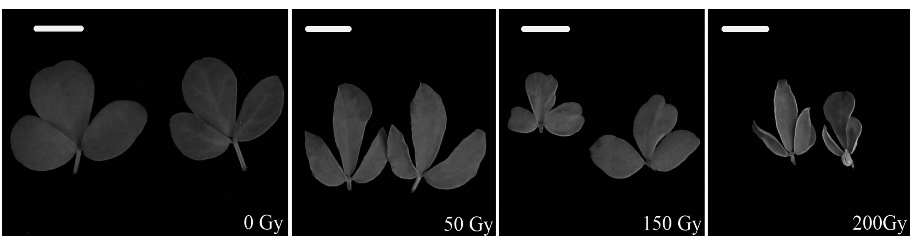

Fig. 1 Phenotypicvariations induced by carbon ions in *Lotus japonicus*. Scale bars, 5 mm.

In order to investigate the effect of carbon ions on the phenotypes of M_1 plants, 30-day-old plants were used to capture photos. Fig. 1 shows the typical representative phenotypic variations observed in the M_1 plants: compared to the control, treatment groups displayed emaciated and narrow leaves, meanwhile they seemed to be more yellow.

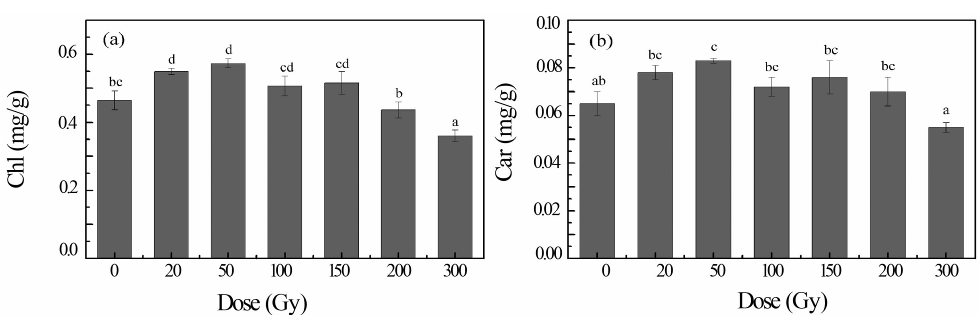

Fig. 2 The effect of carbon ions on the photosynthetic pigments contents of *Lotus japonicus*. (a) total chlorophylls; (b) carotenoids. Data represent mean ±SE of three independent experiments. Different lowercases indicate a significant difference at $p<0.05$.

As the primary and accessory pigments in photosynthesis, the contents of chlorophylls and carotenoids were sensitive to carbon ions. Fig . 1 shows the contents variation of total chlorophylls and carotenoids with the increased dose of carbon ion irradiations. Both the total chlorophyll, and carotenoid show the 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

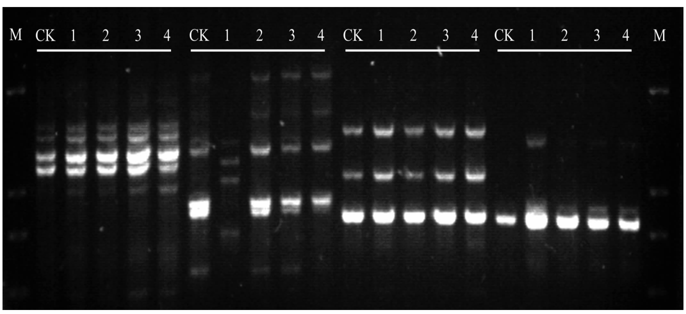

Fig. 1 RAPD patterns of control sweet sorghum plants and plants from seeds irradiated by carbon ion beam by primers S104, S113, S117, and S135. CK means the control. M is DL2000. 1～4 are four plants from seeds irradiated by carbon ion beam with different doses of 120, 160, 200, 240 Gy, respectively.

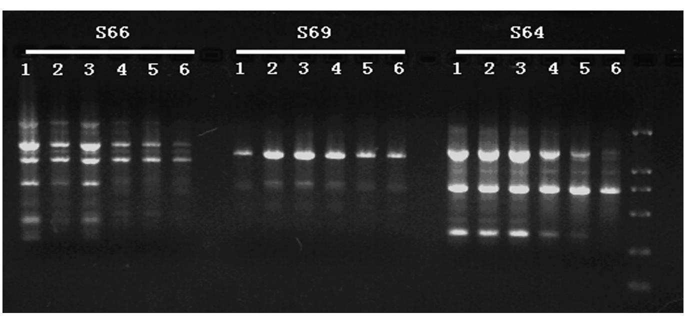

Fig. 2 RAPD pattern of KFJT-CK and KFJT-1 by primers S66, S69, S64. M is DL2000. 1～3 represented KFJT-CK and 4～6 represented KFJT-1. 1～3 and 4～6 represented three replications of KFTJ-CK and KFJT-1 from the same primer, respectively.