

Effect of C-ion beam irradiation on survival rates and flower color mutations in static (*Limonium sinuatum* Mill.)

D. Ogawa,^{*1} T. Fujioka,^{*1} T. Hirano,^{*2} and T. Abe^{*2,*3}

Static (*Limonium sinuatum* Mill.) is one of the popular cut flowers for flower arrangement or flower tribute because of the long-term keeping quality of the flower and wide variety of flower color. Generally, flower color of static, which is defined by the color of the calyx, can be classified into five groups: purple, pink, blue, yellow, and white. Wakayama Prefecture, which is the major static-producing region of Japan, has developed 7 cultivars by cross-breeding. However, a superior pink cultivar has not been developed. Therefore, we aimed to obtain static mutants with pink calyx by heavy-ion beam irradiation. In this study, we investigated the suitable doses of heavy-ion beam irradiation for static and flower color mutations.

Multiple-shoot cultures of static Kishu Fine Grape were irradiated using C-ion beam (LET 23 keV/ μm) at doses of 5–30 Gy. After irradiation, the samples were cut into single shoot segments and transferred to a medium supplemented with 0.2 mg/l α -naphthaleneacetic acid for root induction. Eight weeks after irradiation, the surviving shoots and rooted shoots were counted (Fig. 1). The survival frequency of the shoots was found to be 95.5% when the irradiation dose was 5 Gy. On the contrary, at doses of over 10 Gy, the survival frequency apparently decreased. The rooting frequency of the shoots decreased from 87.7% at 0 Gy to 29.9%. No root formation was observed at 5 and 10 Gy. These results suggest that the suitable dose of C-ion irradiation for static is less than 5 Gy.

Thus, for the improvement of flower color, we irradiated one purple cultivar (Kishu Fine Grape) and two light purple cultivars (Kishu Fine Lavender and Kishu Star) with C-ion beams at doses of 2 and 5 Gy in our further experimentation. Four weeks after the irradiation, the rooting rates of Kishu

Star were 87.5%, 87.3%, and 67.7% at 0, 2, and 5 Gy, respectively. Similar results were obtained for the other cultivars Kishu Fine Grape and Kishu Fine Lavender (data not shown). The rooted plants were acclimated to outside conditions and subsequently transplanted to pots containing soil.

Table 1 shows the flower-color mutants obtained in this study. Among the 3 cultivars, Kishu Fine Lavender and Kishu Star showed flower color mutations. However, we failed to obtain the mutants from Kishu Fine Grape. Six mutants were induced from Kishu Fine Lavender. All six mutants exhibited paler flower color (e.g., Royal Horticulture Society [RHS] Color Chart value N91D) than that of the original cultivar (RHS Color Chart value N87D). Ten mutants were induced from Kishu Star. Among them, 5 and 2 were pale and deep color mutants, respectively (Fig. 2). The other 2 mutants changed to reddish color (e.g., RHS Color Chart value N81C).

Although a pink-colored mutant was not obtained in this study, we confirmed that flower color mutants of static could be obtained by heavy-ion beam irradiation. Furthermore, other interesting mutations were found, such as small flower, variations in the calyx shape, and no hair on the peduncle (data not shown). These results suggest that heavy-ion beam irradiation is effective for developing various useful mutants in static. Mutant screening for the above-mentioned aim are currently in progress.

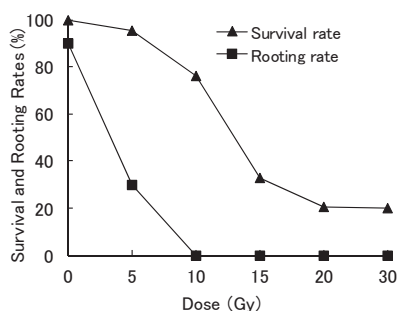


Fig. 1. Effect of C-ion beam irradiation on the survival and rooting rates in static Kishu Fine Grape. Data were recorded 8 weeks after the irradiation.

Table 1. Type and number of flower color mutants by C-ion beam irradiation.

Cultivars	Dose (Gy)	No. of plants investigated	No. of mutants		
			Pale color	Deep color	Reddish color
Kishu Fine Grape	0	16	0	0	0
	2	60	0	0	0
	5	14	0	0	0
Kishu Fine Lavender	0	20	0	0	0
	2	166	4	0	0
	5	51	2	0	0
Kishu Star	0	10	0	0	0
	2	52	3	2	1
	5	20	2	0	2

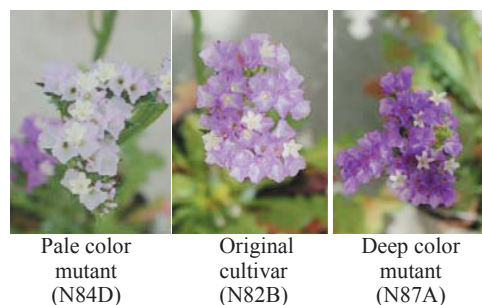


Fig. 2. Flower color mutants of static Kishu Star. Royal Horticulture Society Color Chart values are indicated in parentheses.

^{*1} Horticultural Experiment Center, Wakayama Agricultural Experiment Station

^{*2} RIKEN Innovation Center

^{*3} RIKEN Nishina Center