Development of new cultivar of Hibiscus by C-ion beam irradiation

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Hibiscus is a well-known flowering shrub that belongs to the mallow family (Malvaceae). There are a lot of cultivated varieties over the world with wide variations in flower color and shape. It is popular in Japan as an ornamental plant. We, Hanakongou Co. Ltd., have developed original cultivars of Hibiscus and nine of them are currently in the market. In this study, we attempted mutation induction by heavy-ion beam irradiation to increase the variations in flower colors of our original cultivars. Consequently, we successfully developed a new color cultivar from 'mother-pink' (Fig. 1).

Two kinds of cultivars ('mother-pink,' 'moon-light') and a strain called dark-red of hibiscus were used for the irradiation treatment in 2014. The cuttings were irradiated with C-ion beams (LET 23 keV/μm) at doses of 10, 20, 30, and 40 Gy. The irradiated cuttings were planted in the soil and the rooted cutting was cultivated in a greenhouse. The number of survived plants were counted after seven months. Table 1 lists the number of survived plants. There was no decrease in the survival at 20 Gy in 'mother-Pink' and 'moon-light.' However, the survival rate at 20 Gy was lesser than 50% in dark-red. We multiplled cuttage from 'mother-pink' irradiated with 20 Gy. The growth of irradiated cuttings varied individually even with high survival rate. No mutation in the color of flowers or leaves were observed in the survived 35 plants. We selected the plants with well rooting from the 35 plants and produced 500 cuttings in 2015. Some plants grown from these cuttings had leaves with a lighter color and no mutation in the color of the flower was observed. Propagation by cutting was repeated in 2016 and we cultivated 1,300 plants. We isolated three mutated plants with orange flowers from the 1,300 plants. A stability in the flower color mutation was confirmed by cultivating 60 cuttings from three plants in 2017. Although the flower size, intensity of flower color, and length of internode were different, all plants bloomed with orange flowers. The percentage of plants that had deep orange colored flowers and suitable internode length for potted flowers was approximately 90%. We used these plants for propagation. The traits of the mutant were evaluated in 2018 using 500 cuttings from the selected plant. The characteristics of mutant flower are listed in Table 2. These traits were almost stable. 'Mother-Pink' has a characteristic of continuously blooming, even in the hot summer season. We confirmed that the selected mutant maintained this excellent characteristic. This mutant is named 'mother-orange' and it is under application for variety registration.

Fig. 1. Flower of mutant. Original 'mother-pink' (left) and new cultivar 'mother-orange' (right).

Table 1. Effect of C-ion beam irradiation on survival in Hibiscus.

	Dose (Gy)	Number of cuttings		
		Irradiated	Planted	Survived
Mother-pink	20	44	35	35
	30	40	23	9
	40	35	4	0
Moon-light	10	41	41	41
	20	40	40	39
	30	40	36	8
Dark-red	10	29	29	28
	20	30	30	14
	30	25	25	1

Table 2. Comparison of flower characteristics between original cultivar ('mother-pink') and mutant.

	Shape			Color*				
	Shape	Direction	Diameter	Bud	Petal (Banded type)		Staminal column	Filament
					Band 1	Band 2		
Original	Trumpet-shaped	Horizontal	14 cm	45A	155B	52C	20D	White
Mutant	Horizontal	Upward	12 cm	53B	5A	N30A	15D	Pale red

*: Definition of color groups from RHS (The Royal Horticultural Society) color chart. 45A: Vivid red, 53B: Strong red, 155B: Yellowish white, 5A: Brilliant Greenish Yellow, 52C: Deep Pink, N30A: Vivid Reddish Orange, 20D: Pale yellow, 15D: Light yellow

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