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Short Communication

Responses of 17 Species of Cut Flowers to Electron Beam Irradiation

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Abstract : Seventeen species of cut flowers were exposed to electron beams (5MeV), and the responses of them to irradiation were researched in order to contribute to the development of irradiation treatment as a quarantine procedure. Twelve species of the tested plants were tolerant to irradiation, the other species were sensitive with various injuries.
Key words : radiation, cut flower, commodity treatment, injury, shelf life

Introduction

Visible injuries on irradiated cut flowers are similar to physiological disorders by other reasons including damages in transit, and it is difficult to clearly distinguish these injuries without direct comparison between non- and irradiated plants (TANABE, *et al.*, 1994). Prior to the practical use of irradiation, comparative investigation is important to prevent problems in commercial activities of cut flowers. Thus, 17 species (9 cultivars) of cut flowers were irradiated with electron beams to obtain fundamental information for their responses to irradiation.

Materials and Methods

Experiments were conducted with 17 species of cut flowers shown in Table 1. These cut flowers were produced by commercial growers and harvested 3 ~ 4 days before irradiation, when plants were at their commercially optimum stage. In the case of postharvest application of preservative, that was described in remarks of Table 1. Plants were irradiated in a Cockroft-Walton's accelerator (Dynamitron®, 5MeV, Sumitomo Heavy Industries, Ltd.) according to our previous measures (TANABE and DOHINO, 1993). The absorbed dose was regulated by changing the speed of cart conveying plants.

After irradiation, stem ends of plants were cut and soaked in tapped water without

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Table 1. List of 17 species cut flowers examined

No.	Plant	Place of production	Remarks
1.	*Dendrobium* Pramot	Okinawa	S size, pink
2.	*Oncidium* Gower Ramsey	Okinawa	M ~ 2L size, yellow
3.	*Lilium* cv.'Casa Blanca'	Kagoshima	White, buds
4.	Common calla, *Zantedeschia aethiopica*	Aichi	3L size, white
5.	Common gypsophila, *Gypsophila elegans*	Aichi	White, STS-treated
6.	*Anthurium andreanum*	Chiba	Red
7.	*Alstroemeria* cv.'Serena'	Aichi	White, STS-treated
	Alstroemeria cv.'Yellow Crown'	Aichi	Yellow, STS-treated
8.	*Limonium sinuatum* cv.'New Blue'	Nagano	Blue
	Limonium sinuatum cv.'Sophia Soft Pink'	Nagano	Pink
9.	Stock, *Mattiola incana* (white type)	Chiba	White
	Stock, *Mattiola incana* (pink type)	Chiba	Pink
10.	*Freesia hybrida*	Izuooshima	White
11.	*Gerbera* cv.'Chacha'	Aichi	Red, STS-treated
12.	Sweetpea, *Lathyrus odoratus* cv.'Diana'	Aichi	Pink, STS-treated
13.	*Iris* cv.'Blue Magic'	Chiba	Blue
14.	*Gloriosa rothschildiana* cv.'Rose Queen'	Aichi	Red
15.	*Phoenix roebelenii*	Hachijojima	Leaf
16.	Bellflower, *Campanula medium*	Niigata	M ~ 2L size, pink
17.	Tripet lily, *Triteleia laxa*	Chiba	Blue, STS-treated

preservatives. The water was exchanged every 2 ~ 3 days. Irradiation date and storage conditions were described in a marginal note of Table 2.

Results and Discussion

Symptom of injuries and vase-life of irradiated cut flowers were shown in Table 2.

There were various injuries which occurred on the 5 species. In *Lilium* (cv. 'Casa Blanca'), irradiation gave various effects on flowering. As the dose increased, delayed flowering and smaller flowers were observed. Finally, at 0.6kGy flowering was inhibited. Irradiation reduced vase-life of Araceae. Irradiated common calla, *Zantedeschia aethiopica*, and *Anthurium andreanum* showed bent petiole and withered bract leaf, and these tissues remarkably lost resilience. The injuries caused a large reduction of their vase-life. In *A. andreanum*, 7 days after irradiation, the decrease of water content of bract leaf was 1 ~ 2 %. It is not clear that inhibition of water uptake is a significant factor. Treated sweetpea, *Lathyrus odoratus* (cv. 'Diana') showed severe abscission at peduncle base before withering of petals, and flowers easily fell by means of slight mechanical shock. This suggests that irradiation acts on the abscission layer. Irradiation inhibited the flowering of *Iris* (cv 'Blue Magic'). Necrosis of bud edge and chlorosis of leaf spoiled the commercial value.

Absorbed dose at 0.4kGy seems to be needed for sterilizing or killing of two spotted spider mite, *Tetranychus urticae*, comstock mealybug, *Pseudococcus comstocki* and American serpentine leafminer, *Liriomyza trifolii* (DOHINO and TANABE, 1993; DOHINO and TANABE, 1994; DOHINO and

MASAKI, 1995; KUMAGAI and DOHINO, 1995). Judging from our disinfestation tests, although further studies must be required, irradiation as a qurantine treatment seems to be useful for 12 species as follows; *Gypsophila elegans*, *Alstroemeria* (cv. 'Serena', 'Yellow Crown'), *Limonium sinuatum* (cv. 'New Blue', 'Sophia Soft Pink'), *Matthiola incana* (white type, pink type), *Freesia hybrida*, *Gerbera* (cv. 'Chacha'), *Gloriosa rothschildiana* (cv. 'Rose Queen'), *Phoenix roebelenii*, *Campanula medium*, *Triteleia laxa*, *Dendrobium* Pramot and *Oncidium* Gower Ramsey. However, 5 species of the tested plants were more sensitive to electron beam irradiation; i.g. *Lilium* (cv. 'Casa Blanca'), *Zantedeschia aethiopica*, *Anthurium andreanum*, *Lathyrus odoratus* (cv. 'Diana') and *Iris* (cv. 'Blue Magic').

Table 2. Symptom of injuries and vase-life of irradiated cut flowers

No.* Plant Dose (kGy)	Symptom	Vase-life (days)
1. *Dendrobium* Pramot		
0	—	24
0.2	Not significant difference	24
0.4	Slight abscission and withering of flower	21
0.6	Do.	19
2. *Oncidium* Gower Ramsey		
0	—	38
0.2	Not significant difference	38
0.4	Do.	34
0.6	Withered petals	31
3. *Lilium* cv.'Casa Blanca'		
0	—	11~12
0.2	Delayed flowering, smaller flower diameter	9~10
0.4	Inhibition of flowering in upper florets, smaller flower diameter, withered petals, shorter vase-life	8
0.6	Inhibition of flowering, withered petals, partial browning on petals, shorter vase-life	7
4. Common calla, *Zantedeschia aethiopica*		
0	—	12~19
0.2	Bent petiole, shorter vase-life	4~ 5
0.4	Bent or snapped petiole, withered bract leaf, shorter vase-life	3~ 4
0.6	Snapped petiole, withered bract leaf, shorter vase-life	2~ 3
5. Common gypsophila, *Gypsophila elegans*		
0	—	18
0.2	Not significant difference	18
0.4	Do.	17
0.6	Slightly withered petals	16

6. *Anthurium andreanum*		
0	—	14~
0.2	Withered bract leaf	9~14
0.4	Withered and deformed bract leaf	8
0.6	Do.	7
7. *Alstroemeria* cv.'Serena'		
0	—	14~
0.2	Not significant difference	14~
0.4	Do.	14~
0.6	Withered petals and leaves, slight chlorosis of leaves	12
Alstroemeria cv.'Yellow Crown'		
0	—	14~
0.2	Withered petals and leaves	9~14
0.4	Do.	8
0.6	Do., slight chlorosis of leaves	7
8. *Limonium sinuatum* cv.'New Blue'		
0	—	14~
0.2	Not significant difference	14~
0.4	Do.	14~
0.6	Slight chlorosis of leaves and stems	14~
Limonium sinuatum cv.'Sophia Soft Pink'		
0	—	14~
0.2	Not significant difference	14~
0.4	Do.	14~
0.6	Do.	14~
9. Stock, *Mattiola incana* (white type)		
0	—	10~12
0.2	Withered petals of lower florets, bent stem top	9~10
0.4	Do.	8
0.6	Do., chlorosis of leaves	7
Stock, *Mattiola incana* (pink type)		
0	—	9~11
0.2	Withered petals of lower florets, bent stem top	8
0.4	Do.	8
0.6	Do.	7
10. *Freesia hybrida*		
0	—	7
0.2	Not significant difference	7
0.4	Withered petals, smaller flower diameter	6
0.6	Do.	5

11. *Gerbera* cv.'Chacha'		
0	—	12
0.2	Not significant difference	12
0.4	Do.	12
0.6	Slight dehydration of petals, slight discoloration of petal edge	11
12. Sweetpea, *Lathyrus odoratus* cv.'Diana'		
0	—	5
0.2	Severe abscission of flower	4
0.4	Do.	3
0.6	Do.	3
13. *Iris* cv.'Blue Magic'		
0	—	5
0.2	Chlorosis of leaves, necrosis of bud edge	4
0.4	Do., inhibition of flowering	4
0.6	Do.	3
14. *Gloriosa rothschildiana* cv.'Rose Queen'		
0	—	10~11
0.2	Slight discoloration of petals	9~10
0.4	Do.	9~10
0.6	Do.	9~10
15. *Phoenix roebelenii*		
0	—	12~14
0.2	Better than control	21
0.4	Not significant difference	14
0.6	Do.	14
16. Bellflower, *Campanula medium*		
0	—	8~11
0.2	Not significant difference	10~12
0.4	Do.	10~11
0.6	Slight necrosis of petal edge	9~11
17. Tripet lily, *Triteleia laxa*		
0	—	8
0.2	Not significant difference	8
0.4	Do.	8
0.6	Do.	8

* Irradiation date and storage condition of cut flowers after irradiation
No. 1, 2 ; February 16th, 1993., 13±2 ℃, 50~70% r.h.
No. 3~ 5 ; February 24th, 1994., 13±2 ℃, 50~70% r.h.
No. 6~ 9 ; March 9th, 1994., 14±2 ℃, 60~80% r.h.
No.10~12 ; March 16th, 1994., 14±2 ℃, 60~80% r.h.
No.13~15 ; April 20th, 1994., 20±2 ℃, 60~70% r.h.
No.16, 17 ; June 16th, 1994., 25±3 ℃, 60~80% r.h.

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和 文 摘 要

17種切花の照射に対する反応

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5MeVの電子加速器ダイナミトロン*を用いて切花17種を電子線照射し，その後の影響を調べた。

1) カスミソウ，アルストロメリア（‘セレナ’，‘イエロークラウン’），ガーベラ（‘チャチャ’），ストック，グロリオーサ（‘ローズクィーン’）スターチス（‘ニューブルー’，‘ソフィアソフトピンク’），カンパニュラ，フリージア，ロベレニー，トリテリア，デンドロビウム及びオンシジウムは電子線照射に対して比較的耐性が認められた。

2) ユリ（‘カサブランカ’），アンスリウム，アイリス（‘ブルーマジック’），カラー及びスウィートピー（‘ダイアナ’）は照射に対して感受性が高く，植物によって障害の現れ方が異なった。