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Suchismita Mishra
Department of Floriculture and Landscaping, College of Agriculture, Orissa University of Agriculture and Technology, Bhubaneswar, Odisha, India

Sashikala Beura
Department of Floriculture and Landscaping, College of Agriculture, Orissa University of Agriculture and Technology, Bhubaneswar, Odisha, India

Corresponding Author:
Suchismita Mishra
Department of Floriculture and Landscaping, College of Agriculture, Orissa University of Agriculture and Technology, Bhubaneswar, Odisha, India

Effect of gamma rays on vegetative and bud characteristics of Lilium hybrid cv. Zambesi in vM1 generation

Suchismita Mishra and Sashikala Beura

Abstract
An experiment was carried out to study the effect of gamma rays on vegetative and bud characteristics of Lilium hybrid cv. Zambesi in vM1 during the year 2019-2021. The experiment consisted of randomized block design with four treatments. The result revealed that in vM1 generation different gamma ray doses had major effect on the vegetative and bud parameters. Generally, the treated population had reduction in all the parameters in vM1 generation compared to control. Maximum plant height, leaf length, leaf width and basal stem were observed in T_1 (control) and minimum was observed in higher dose i.e. T_4 (5.5 gy) gamma ray. Similarly, days to bud appearance and bud break were delayed at higher doses of gamma ray (*viz*. 3.5 gy and 5.5 gy) as compared to control.

Keywords: Lilium, gamma rays and bulbs

Introduction
Flower represents the symbol of love, beauty & passion and is one of most beautiful creation of God (Phare and Beura, 2022) [12]. Flowers play important role in life and its importance have also stretched to worldwide economy. They represent the soul of garden without which the garden would be dull. Due to rise in growth of floriculture sector in global and India market government has linked this sector as daylight assiduity which states to be 100% export-oriented level. One of the six main genera of flower bulbs grown worldwide is Lilium (Nard and Hertogh, 1993) [10]. Lilium is bulbous ornamental plant and it has been known for periods as apparent from stamped by Palestinian coin marker in 143 BC (Bose *et al*., 2003) [5]. The Archangel Michael used the lily as a symbol of love in Christianity and also Virgin Mary is frequently seen with Gabrid and her parents holding a lily. They are cultivated as cut flowers and potted flowers, and they are utilised in landscaping (Dole & Wilkins, 1999) [7]. It is a species that is very economically significant in the production and marketing of cut flowers on the global market (Jiménez *et al*., 2012) [8].

Lilium is one of the top ten cut flowers in the world due to its size, beauty, and longevity (Thakur *et al*., 2005) [16]. This plant ranks fourth among cut flowers due to its large, gorgeous blossoms and long flowering season. (Thakur *et al*., 2006) [17]. Lilium species are native to some regions of northern hemisphere including Asia (China and Japan), northern America, Mediterranean regions of Europe and north of Africa. Lilium is commercially cultivated in different parts of India like, The Nilgiris (Cooner, Ooty, Kothagiri), Kalvarayanhills (Karumanthurai) Kodaikanal, Shevroyhills (Yercad), Himanchal Pradesh i.e under Shimla and Kullu condition, North Eastern states like Arunanchal Pradesh, Manipur, and Jammu and Kashmir etc. The popularity of lilium is rising in our country due to their large and attractive flowers having capacity to rehydrate after a long transportation. Lilium is native of northern hemisphere up to South Canada and Siberia and their southern limit is Florida and India. At present 100 species of lilium are found in temperate and sub-tropical zone of northern India (Nhut, 1998) [11]. This species is a valuable from the horticulture point of view, because of its fragrant prosperities, colour spectrum, and adaptability to different environmental conditions, and is commercially used as a cut flower to improve the beauty of gardens (Ko *et al*., 2002).

Induced mutation by gamma radiation have been used since ages in crops specially in flower crops for genetic changes, disease resistance etc (Tirkey and Singh, 2019) [18]. They are known to influence growth and development of plant by creating genetical, cytological and biochemical changes in the cell (Abdullah *et al*., 2009) [1]. The objective was to see the effect of gamma rays on different parameters in Lily. Mutation breeding seems to be crucial for the

genetic advancement of plants as an alternative method. Ionizing radiation and various chemical mutagens are typically what cause mutations. (Amin, 2015) [3]. Among them, gamma radiation are generally used mutagen to create variation in plants. Gamma rays cause deletions, chromosomal rearrangements and hence produce new source of genetic variability in plants (Bhat, 2007) [4]. The application of gamma radiation has been found to be easy (Toker, 2007) [19]. Gamma rays were successfully used to develop many cultivars in different ornamental plants (Tomlekova, 2010) [20].

Materials and Methods

A field experiment was conducted under polyshade net structure at BTCC, OUAT, Bhubaneswar, during the year 2019-2020. The experiment was done in Randomised Block Design (RBD) consisted of 4 treatments and five replications. The treatments consisted of T_1 (Control), T_2 (1.5 Gy), T_3 (3.5 Gy) and T_4 (5.5 Gy) gamma ray doses. Bulbs were irradiated with gamma rays and were planted on the beds. All the necessary cultural operations were carried out after planting. Observations for different vegetative parameters like plant height, leaf length & width etc and bud parameters like days to bud appearance & bud break, no of buds/ plant etc were recorded for vM1 generation and were analysed using OPSTAT.

Result and Discussion

From table 1 the result revealed that maximum height was observed in T_1 (76.00 cm) i.e in control. The decrease in height was observed with the increase in gamma doses where the lowest height was observed in the treatment T_4 (30.16 cm). The highest leaf length was recorded in T_1 (14.13 cm) followed by T_2, T_3 and T_4 recording the minimum leaf length (5.32 cm). Maximum leaf width was observed in T_1 (3.47 cm) followed by T_2, T_3 and T_4. The highest basal stem diameter was recorded in treatment T_1 (8.59 cm) whereas the lowest basal stem diameter was recorded in the treatment T_4. All the vegetative parameters viz., plant height, leaf length, leaf width and basal stem diameter showed a decreasing trend with increase in gamma doses in vM1 generation. The present findings are in agreement with the gladiolus findings of (Tirkey and Singh, 2019) [18] and Sathyanarayana *et al*., (2019) [14].

From table 1 the result revealed that maximum height was observed in T_1 (76.00 cm) i.e in control. The decrease in height was observed with the increase in gamma doses where the lowest height was observed in the treatment T_4 (30.16 cm).

Data from table 2 showed that days to bud appearance was earlier in treatment T_1 (Control) whereas the T_2 delayed the days to bud appearance (42.33 days). Similarly, the days to bud break was also delayed in the treatment T_2 (79.66 days) compared to the control 66 days). The maximum no of buds per plant was observed in control and minimum was recorded in T_2 where as in treatment T_3 and T_4 there was no bud formation. The bud width and bud width were recorded maximum in control and lowest was recorded in treatment T_2 in vM1 generation. The present findings are in agreement with the gladiolus findings of (Tirkey and Singh, 2019) [18].

The growth reduction because of the higher doses can be ascribed to one or more reasons like dropping in the synthesis of auxin in the plant or may be declining of the assimilation mechanism as reported in carnation by Roychowdhury and Tah (2011) [13]. The reduction in plant height, leaf length and width may be ascribed to the growth inhibition because of decrease in cell division, increase in the peroxidase activity and reduction in the amylase activity as reported in maize by Cherry and Lessman, (1967) [6].

Table 1: Effect of gamma rays on vegetative parameters of Lilium hybrid cv. Zambesi

Parameters / Treatments	Plant height	Leaf length	Leaf width	Basal stem diameter
T_1	76.00	14.13	3.47	8.59
T_2	65.80	12.33	2.68	8.26
T_3	33.86	9.65	2.36	7.80
T_4	30.16	5.32	1.67	7.30
S.E(m) ±	1.63	0.68	0.18	0.17
CD (5%)	4.91	2.05	0.54	0.52

Table 2: Effect of gamma rays on bud parameters of Lilium hybrid cv. Zambesi

Parameters / Treatments	Days to Bud appearance	Days to bud break	No. of bud/plant	Bud width	Bud length
T_1	35.44	66.00	2.83	4.15	14.03
T_2	42.33	79.66	2.55	3.20	11.67
T_3	0.00	0.00	0.00	0.00	0.00
T_4	0.00	0.00	0.00	0.00	0.00
S.E(m) ±	0.87	0.50	0.08	0.07	0.16
CD (5%)	2.63	1.51	0.26	0.21	0.49

Conclusion

The result from the conducted experiment showed that all the level of gamma doses affected the vegetative and bud characteristics. The treatment T_2, T_3 and T_4 showed decrease in vegetative characters like plant height, leaf length, leaf width and basal stem diameter of the plants. Similarly the treatments T_2 delayed the bud appearance and bud break whereas there were no bud formation in the treatment T_3 and T_4 compared to T_1 (Control).

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