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Impact of gamma radiation on vegetative and bud characters of Lilium hybrid cv. Zambesi in vM2 generation

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Abstract
An experiment was conducted to study the impact of gamma radiation on vegetative and bud characteristics of Lilium hybrid cv. Zambesi in vM2 generation during the year 2020-2021. The experiment consisted of randomized block design with four treatments. The result revealed that in vM2 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 vM2 generation compared to control. Maximum plant height, leaf length and leaf width were observed in T_1 (control) except number of leaves per plant recorded highest in T_2 while minimum was observed in T_4. Similarly days to bud appearance and bud break were delayed at higher doses of gamma ray (viz. 3.5 gy and 5.5 gy) compared to control. Number of bud per plant and bud length recorded highest in control except bud width where increase was seen in treatment T_2.

Keywords: Lilium, bulbs and M_2 generation

Introduction
Flower is one of God's most beautiful works, signifying the emotions of love, beauty, and passion (Phare and Beura, 2022) [12]. Flowers play a significant role in life, and their significance has spread to the global economy. They represent the garden's soul, without which the garden would be lifeless. Because of the overall growth of the floriculture industry in the worldwide and Indian markets, the government has linked this sector as daylight assiduity, which states that it is 100% export focused. Lilium is one of the six major flower bulb genera planted worldwide. (Nard and Hertogh, 1993) [10]. Lilium is a bulbous decorative plant that has been recognized for a long time, as evidenced by a stamp on a Palestinian coin in 143 BC. (Bose *et al*., 2003) [5]. In Christianity, the Archangel Michael used the lily as a symbol of love, and Virgin Mary is commonly seen with Gabrid and her parents holding a lily. They are grown for cut flowers and potted flowers, as well as for landscaping. (Dole & Wilkins, 1999) [7]. It is a species that is very commercially significant in the global production and selling of cut flowers in world market. (Jiménez *et al*., 2012) [8].
Because of its size, beauty, and longevity, Lilium is one of the top ten cut flowers in the world (Thakur *et al*., 2005) [16]. Because of its huge, beautiful blossoms and long blossoming season, this plant ranks fourth among cut flowers. (Thakur *et al*., 2006) [17]. Some Lilium species are indigenous to the northern hemisphere, including Asia (China and Japan), North America, the Mediterranean regions of Europe, and northern Africa. Lilium is commercially grown in various places of India, including the Nilgiris (Cooner, Ooty, and Kothagiri), Kalvarayanhills (Karumanthurai), Kodaikanal, Shevroyhills (Yercad), Himanchal Pradesh (Shimla and Kullu), and North Eastern states such as Arunachal Pradesh, Manipur, and Jammu and Kashmir. The popularity of lilium is growing in our country due to its enormous and gorgeous blossoms that can rehydrate after a long transportation. Lilium is native to the northern hemisphere, reaching as far south as South Canada and Siberia, and as far south as Florida and India. There are currently 100 species of lilium found in northern India's temperate and subtropical zones (Nhut, 1998) [11]. This species is a valuable one 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) [9].
Gamma radiation-induced mutation has been utilised in crops for centuries, particularly in flower crops, for genetic alterations, disease resistance, and so on (Tirkey and Singh, 2019) [18].

They have been shown to influence plant growth and development by causing genetic, cytological, and metabolic changes in the cell. (Abdullah *et al*., 2009) [1]. The objective was to see the impact of gamma radiation on different parameters in Lily. As an alternate technique for plant genetic development, mutation breeding appears to be critical. Mutations are typically caused by ionising radiation and various chemical mutagens. (Amin., 2015) [3]. Gamma radiation is a common mutagen used to induce variety in plants. Gamma rays cause deletions and chromosomal rearrangements in plants, creating a new source of genetic diversity. (Bhat., 2007) [4]. Gamma radiation application has been (Toker, 2007) [19]. Many ornamental plant varieties have been successfully developed using gamma radiation (Tomlekova, 2010) [20].

Materials and Methods

A field experiment was carried out under the polyshade net structure at BTCC, OUAT, Bhubaneswar, during the year 2020-2021. The experiment was carried in Randomised Block Design (RBD) which consisted of four treatments and five replications. The treatment consisted of T_1 (Control), T_2 (1.5 Gy), T_3 (3.5 Gy) and T_4 (5.5 Gy) gamma radiation doses. Bulbs were irradiated with gamma radiation and were planted on the prepared beds. All the necessary cultural operations viz. irrigation, weeding, fertilizer applications etc were carried out after planting. Observations for different vegetative parameters like plant height, leaf width & leaf length etc and bud parameters like days to bud appearance and bud break, number of buds per plant, bud width and bud length were recorded for generation vM2 and were analysed using OPSTAT [15].

Result and Discussion

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

Parameters / Treatments	Plant height	No. of leaves/plant	Leaf length	Leaf width
T1	80.20	34.88	13.83	3.35
T2	68.33	36.00	12.33	2.50
T3	43.66	25.33	10.30	2.30
T4	37.66	23.66	5.00	2.00
S.E(m) ±	3.50	0.54	0.36	0.10
CD (5%)	10.51	1.62	1.08	0.31

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

Parameters / Treatments	Days to Bud appearance	Days to bud break	No. of bud/plant	Bud width	Bud length
T1	33.00	67.57	2.77	3.46	14.28
T2	40.33	83.67	2.67	3.53	13.66
T3	0.00	0.00	0.00	0.00	0.00
T4	0.00	0.00	0.00	0.00	0.00
S.E(m) ±	0.48	0.38	0.11	0.38	0.61
CD (5%)	1.45	1.15	0.39	1.15	1.84

From table 1 the result showed that highest height was observed in the treatment T_1 (80.20 cm) i.e in the control. The decreasing in height was observed with the increase in the gamma doses where the lowest height was recorded in the treatment T_4 (37.66 cm). Similar result was also observed in leaf length where the highest was recorded in T_1 (13.83 cm) followed by treatment T_2, T_3 and T_4 where the treatment T_4 recorded the minimum leaf length (5.00 cm). Highest leaf width was observed in T_1 (3.35 cm) which was followed by T_2, T_3 and T_4. Maximum leaves number per plant was recorded in treatment T_1 (34.88) while the minimum number of leaves per plant was recorded in the treatment T_4 (23.66). All the vegetative parameters viz., leaf width, leaf length, plant height and number of leaves per plant exhibited a decreasing pattern with increase in the gamma ray doses in vM_2 generation. The present findings are in agreement with the findings of gladiolus by (Tirkey and Singh, 2019) [18] and Sathyanarayana *et al*., (2019) [14].

Data from table 2 showed that earlier days to bud appearance was there in treatment T_1 (Control) while the treatment T_2 delayed the days to bud appearance to 40.33 days. Similar observation was also recorded where the days to bud break was delayed in the treatment T_2 (83.66 days) compared over the control (67.57 days). The highest no of buds per plant was recorded in control while lowest was recorded in T_2 where as in treatment T_3 and T_4 no bud formation was seen. The bud width was recorded highest in T_2 and lowest was observed in treatment T_1 (control). Maximum bud length was observed in T_1 (14.28 cm) and lowest was observed in T_2 (13.66 cm) in vM2 generation. The present findings are in agreement in the gladiolus findings of (Tirkey and Singh, 2019) [18].

The growth reduction caused by greater doses can be attributed to one or more factors, such as a decrease in auxin synthesis in the plant or a decline in the absorption mechanism, as documented in plant carnation by Roychowdhury and Tah (2011) [13]. The decrease in plant height, leaf length, and leaf width may be attributed to growth inhibition due to a decrease in cell division, an increase in peroxidase activity, and a decline in amylase activity, as documented in maize by Cherry and Lessman, (1967) [6].

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