EFFECT OF GAMMA IRRADIATION ON MORPHOLOGICAL CHARACTERS OF MARIGOLD (Tagetes erecta L.)

Arjun V. Bhusari, Mangesh R. Deshmukh, Surdes R. Bhagat*
Mahatma Phule Krishi Vidyapeeth Rahuri, College of Agriculture, Pune-411005, India
*Corresponding email address: mrdesh101@yahoo.co.in

ABSTRACT
Seeds of marigold cv. ‘Pusa Narangi Gainda’ were treated with different gamma irradiation treatments viz, control, 25 Gy, 50 Gy, 75 Gy, 100 Gy, 125 Gy and 150 Gy and evaluated for various morphological characters. Reduction in survival percentage, plant height, number of branches and plant spread was observed after irradiation and with increase in exposure of gamma rays. Early flower bud initiation and flower opening was observed in lower dose of gamma rays. Flower diameter, number of flowers and length of peduncle was significantly highest at the lowest dose of gamma irradiation. The stimulatory effect of gamma irradiation was observed at 25 Gy in almost all the characters, though the intensity of inhibition increased with increasing exposures of gamma rays. On the basis of present observation, it may be concluded that irradiation of gamma rays of 25 Gy was found to be beneficial for growth and flowering characters in African marigold cv. Pusa Narangi Gainda.

Key word: Marigold, Tagetes erecta, gamma irradiation.

INTRODUCTION
Out of leading loose flowers, marigold (Tagetes erecta L.) is one of the important popular commercial flowers widely grown throughout the world. It belongs to family Compositae and genus Tagetes. Origin of marigold is Central and South America, especially Mexico (Kaplan, 1960). It is universally a popular seasonal flower grown as an ornamental, lose or cut flower, bedding, pot or landscape plant, easy to cultivate with worldwide adaptability to varying soil and climatic conditions. Marigold with its bright colors ranging from yellow to orange is the best for combination in any color scheme. The attractive and brilliantly colored flowers are the most valuable economic part of the plant, used for garland making, religious offerings, exhibitions, decorations, etc. Apart from this, ‘Thiopenes’, a chemical compound extracted from the leaves of marigold is used as mosquito repellent. The whole plant is a source of an essential oil used in perfume industry; the roots of Tagetes sp. secrete an alkaloid which has the strong nematicidal property (Bose and Yadav, 1989). The major problem in its cultivation is lack of standard varieties with this objective so many workers have tried to improve marigold by breeding, resulting in novel cultivars but very meagre little work has been reported on mutation breeding. Therefore, it has now become imperative to concentrate on research and to develop our own and new genotypes by making a change in the genetic makeup of existing cultivars, to make the technology cheap and cost effective. Conventional breeding is a time consuming process for genetic improvement of the floricultural crops. Mutation breeding is also an efficient way to produce heritable changes, particularly for flower colors. Induced mutations are highly effective to enhance natural genetic resources (Jain, 2006). Singh et al. (2016) studied the effect of irradiation on Pusa Narani Gainda with different doses i.e. 0,100, 200, 300, 400 grays for induction of mutation. The effects seen were reduction in survival percentage, plant height, number of branches, leaf number, plant spread, size of leaves and diameter of stem, increased foliage and floral abnormalities in higher doses of gamma irradiation. Therefore the present investigation on the effect of gamma irradiation on morphological characters of African marigold was carried out.

OBJECTIVES
Taking lower doses of gamma irradiation with the objective to explore the possibilities of physical mutagens to create variability in marigold and to study the morphological changes in African marigold as a result of mutagenesis.

MATERIAL AND METHODS
The seeds were irradiated with different doses of gamma rays (60Co) having strength of 25 Gy, 50 Gy, 75 Gy, 100 Gy, 125 Gy and 150 Gy at Nuclear Agriculture and Biotechnology Division, Bhabha Atomic Research Centre, Trombay, Mumbai, India. The experiment was conducted at Modibaug, College of Agriculture, Pune, during 2013-14. Seedlings of treated seeds were raised on raised beds. Five weeks old seedlings were transplanted at 45cm X 45cm distance on ridges and furrows. The experiment was laid out in randomized block design with seven treatments and three replications. Data were recorded on various growth characters viz. survival percentage, plant height, number of branches per plant, plant spread and flowering characters such as days required for flower bud initiation, days required for flower opening, diameter of flower, length of the peduncle and the number of flowers per plant.

RESULTS AND DISCUSSION
Significant reduction in plant height, number of branches per plant, plant spread, and days required for flower bud initiation, days required for flower opening, diameter of flower, length of the peduncle and the number of flowers per
The results indicate that flower bud initiation was earlier in 25 Gy (30.33 days) while those irradiated with 150 Gy took longer time (34.13 days) for bud initiation. These results corroborate the findings of (Datta and Gupta, 1981) and Singh et al. (2016). As a result of irradiation many biosynthetic pathways are altered, which are directly and indirectly associated with the flowering physiology (Mahure et al., 2010). The diameter of the flower was also influenced significantly by irradiation. Flower diameter decreased with increase in gamma rays at 50 Gy. Smaller flower diameter (4.58 cm) was recorded at 150 Gy of gamma rays. Reduction in length of peduncle with increase in dose of gamma irradiation was recorded except in lower treatment dose 25 Gy where increase in the length of peduncle was observed in comparison with control. Earlier, Kumari et al. (2013) also recorded reduction in flower bud initiation, flower diameter and length of peduncle in chrysanthemum and concluded that the reduction could be due to physiological, morphological and cytological disturbances caused by gamma irradiation. The maximum number of flowers per plant (37.20) was recorded in 25 Gy which was significantly superior to the remaining doses and control. The number of flowers per plant was found to be minimum (27.53) in 150 Gy. The decreased in number of flowers per plant with increased dose may be due to decrease in plant height, plant spread and number of branches per plant.

Plant survival, height, spread and number of branches declined upon irradiation. The reduction was highest mostly at higher doses. Flowering characters also affected after gamma irradiation. Stimulatory effect has been recorded at lower dose i.e. 25 Gy where plant height, spread, branch number, diameter of flower, number of flowers per plant and length of peduncle increased. Sax (1963) reported stimulation of plant-growth with lower doses of ionizing radiation. In case of marigold the intensity of inhibition increased with increasing exposures though lower exposure in some cases was stimulatory. Sparrow (1954) reported inhibition of plant growth by ionizing radiation.

**CONCLUSION**

On the basis of present observation, it may be concluded that irradiation of gamma rays of 25 Gy was found to be beneficial for growth and flowering characters in African marigold cv. Pusa Narangi Gainda.

**REFERENCES**


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