International Journal of Botany Studies
www.botanyjournals.com
ISSN: 2455-541X
Received: 22-08-2021, Accepted: 06-09-2021, Published: 22-09-2021
Volume 6, Issue 5, 2021, Page No. 791-793

Mutagens (gamma rays and EMS) induced floral abnormalities in *Brassica campestris* L. toria cultivars *viz*. T-9 and PT-303.

Gopal Krishna Shukla
Assistant Professor, Department of Botany, Kisan PG College, Bahraich, Uttar Pradesh, India

Abstract
The massive advent of induced mutagenesis is becoming more powerful and effective approach for breeding improved crop varieties and continues to play a significant role for improving world food security in coming years and decades. Keeping this in view, the seeds of two cultivars of *Brassica campestris* L. toria *viz*. T-9, PT303, were treated with different doses of physical mutagen (Gamma rays) and chemical mutagen (EMS) for creating variability and selection of improved genotypes. The frequency of morpho-floral variants were screened in M_1 generation. It has been observed that frequency of pale yellow, albino, reduced sized petals and apetalous flowers were maximum at higher doses. Plants with increased number of petals, fused petals, large petal flowers were more at lower doses of gamma irradiation and moderate dose of EMS in both cultivars. The plants flower with apetalous and small sized petals as component of high yield. These results suggested that mutagens play a significant role in the alteration of plant architecture and could be utilized further *Brassica* improvement program.

Keywords: *Brassica campestris*, gamma rays, EMS, chlorina, floral variants

Introduction
For a successful breeding program, presence of a great magnitude of heritable variation in gene pool of a crop is a prerequisite. Induced mutagenesis has been perceived as an important tool to create additional variability for qualitative and quantitative traits [1]. Hence induced mutagenesis is gaining importance in plant molecular biology and it is becoming more powerful and effective in breeding crop varieties and continues to play a significant role for fulfilling world food requirements. Mutagenesis has a number of advantages over other approaches, as mutagens introduce random changes throughout the genome, generating a wide variety of mutation in all target sites and a single plant contains a large number of different mutations, results a manageable population size. This mutation can be followed by selection and evaluation of desirable trait. Fats or vegetable oils are major components of human and animal diet and richest source of energy [2]. India is the fifth largest oilseed producer accounting for 8% of global oilseed production[3]. Many oils producing crops are grown for this purpose such as groundnut, rapeseed/mustard, cottonseed, sesame, palm and sunflower. Among these oilseed crops, oilseed *Brassica* species (also known as rapeseed /mustard) are most important one and grown throughout the world as a source of oils and protein for human/animal consumption and other commercial purposes [4]. In India, rapeseed/mustard is second most important edible oil crop, next only to groundnut, cultivated in Assam, Bihar, Gujarat,H.P.,Jammu & Kashmir, Madhya Pradesh, Orissa,P unjab, Rajasthan, Uttar Pradesh and West Bengal as a Rabi crop. *Brassica campestris* (L.) belongs to family *Brassicaceae* is a sparsely branched annual herb. Flower is yellow, widely spread and attractive to insects when open, they are regular and cruciform bisexual, complete and hypogynous. The calyx has 4 unattached sepals in 2 whorls. The corolla consists of 4 free petals in one whorl, each with distinct limb and claw. The androecium consists of 6 stamens in 2 whorls (tetradynamous condition) the ovary is superior, at first one celled but subsequently 2-celled because of the development of the false septum replum, ovules having parietal placentation [5]. The pollen grains are viable up to seven days while stigma is receptive for three days prior and three days after the opening of flowers. The siliqua are plumpy with slightly flattened beak. Seeds are rounded, brown in color with smooth seed coat, non-endospermic and contain40% or more oil (poly unsaturated fatty oil) and about 35- 40 % protein matter. The oil contains lowest amount of saturated fatty acids as compared to other vegetable oils. It contains nutritionally desired oleic acid, which gives stability to the oil, along with two essential fatty acids, linoleic and linolenic, which are not present in many of the other edible oils. *Brassica campestris* is one of the major contributors of *Yellow Revolution* in India and favored more due to earliness and higher oil content. In spite of its considerable value, there exists a gap between production potential and actual realization of their productivity because of their susceptibility to drought and salinity stress and unavailability of improved varieties. Breeding oilseed *Brassica* varieties with enhanced drought and salt tolerance is considered as a promising, energy efficient and economical approach than soil amelioration and engineering process which have gone beyond the marginal farmers[6]. Keeping this in view, the present study aimed possibility of inducing variability in oilseed *Brassica* in order to enhance drought and salt tolerance capacity.

Materials and Methods
The present work focused on mutation induction and selection of genetic variability in *Brassica campestris.* Keeping this view, two cultivars T-9 and PT-303 of *Brassica campestris* var. toria were used. The seeds were obtained from U.P. State Seed Corporation, Lucknow. In

order to induce genetic variability in both varieties, artificial mutagenesis had been carried out by using physical mutagen (Gamma rays) and chemical mutagen (Ethyl Methane Sulphonate). For physical mutagenesis, three lots of each variety were subjected to 25, 35 and 45 Krad doses of gamma irradiation at room temperature at National Botanical Research Institute, Lucknow. The source of gamma rays was ^{60}CO.

In chemical mutagenesis, the seeds of both the cultivars (four lots of each) were presoaked for 4 hrs in distilled water and then treated with different concentrations (0.3,0.6 and0.9%)of E.M.S. solution prepared in phosphate buffer at pH 7.0 for 6 hrs at 30±1°C reaction temperature. The treated seeds of both the varieties along with their respective control were sown at the experimental field in Randomized Block Design (RBD) to rise the M_1 generation in three replicates. Seeds were hand dibbled approximately an inch deep with the spacing of 10- 12 cm between them in a well loosened and watered soil. The rows were kept at a distance of about 30 cm with plants at a spacing of 15 cm in each row. All the necessary care was taken during experiment.

Results and Discussion

In the present investigation different types of morpho- floral variants were observed in M_1 generation at the different doses of gamma rays and EMS in both cultivar T-9 and PT303.

Chlorophyll Variants

Several type of chlorophyll variants such as albina, xanthina, chlorina were observed in M_1 generation. Albina lack chlorophyll and could survive only few days. Albina, xanthina and chlorina variants were observed in both varieties in gamma rays and EMS treatment. The gamma rays treatments were found more effective to induce chlorophyll mutation as compared to EMS. Earlier 4 types of chlorophyll mutant *viz*. albina, xanthina, chlorina and viridis in gamma rays and EMS treated population of soyabean [7] and higher frequency of albina mutants in *Brassica* [8]. The frequency of chlorophyll variants was found more in variety PT-303 then T-9. Therefore it was concluded that same mutagen dose can cause different degrees of effect in different cultivars. Similar varietal differences were recorded in *Nigella sativa* [9] and *Delphinium* [10]. Previous studies [11, 12] suggested that the chlorophyll development seems to be controlled by many genes located on several chromosomes which could be adjacent to centromere and proximal segment of chromosome. The chlorophyll mutation frequency is an indicator to predict the frequency of factor mutations and thus an index for evaluation of genetic effects of mutagens [13].

Floral Variants

In M_1 generation, during flowering, some plants at different doses having floral abnormalities such as change in color and number of petals. Plants with albino and pale yellow flowers were found in both the varieties but more in gamma rays as compared to EMS. Variation in number of petals from 5-6 and up to 8 petals found in variants of both varieties T-9 and PT 303(Fig.A-F). In relation of mutagens and doses it was observed that at 25 kR dose of gamma rays and 0.6% dose of EMS produces high frequency of floral variants. These results confirm the earlier findings[14] and suggested that abnormal numbers resulted from splitting of petals. Flowers with reduced petals size, unequal petals and even apetalous condition also found at higher doses of mutagens and frequency is more in EMS treatment. Apetalous flower does have larger flower part other then petals which could contribute to the larger pod and seed [15]. Genotypes with apetalous flowers might have the advantage to avoid biotic and abiotic stresses [16].

Fig 1: Floral variabilities in *Brassica campestris* (L.) Fig. A. control, B. Pale yellow, C, D and F. Fused Flowers, E, F. 6-8 Petalous flower.

Conclusion

From the above results it could be concluded That induced mutation through gamma rays and EMS play a significant role to create variation within the crop variety and useful for generating novel trait. Plants having apetalous and small sized petals as component of high yielding and stress resistant ideo type and this would help to stabilize the oilseed *Brassica* cultivation in drought and salinity prone agricultural land of the country.

Acknowledgement

The author thankful to UP state seed Corporation, Lucknow for providing germplasm and N.B.R.I. ,Lucknow for irradiating experimental material.

References

1. Brock RD. The role of induced mutation in plant improvement. Radiat. Bot,1971:11:181-196.
2. Downey RK. Canola: A quality Brassica oilseed. In: J. Janick and J.E. Simon (eds.). Advances in New Crops, Timber Press, Portland, 1990, 211-215.

3. http://agricoop.nic.in
4. Friedt W, Snowden R, Ahlemayer J. Plant Breeding: assessment of Genetic Diversity in Crop Plant and its Exploitaion in Breeding. Progress in Botany, 2007:168:152-177.
5. Murphy DJ. *Brassica species*. Designer Oil Crops Breeding, Processing mutation. Teck. Rep,1994:Ser. No. 86: IAEA, Vienna.
6. Ashraf M, McNeilly T. Salinity tolerance in *Brassica* oilseeds. Crit. Rev. Plant Science,2004:23:157-174.
7. Khan MH, Tyagi SD. Studies on effectiveness and efficiency of gamma rays, EMS and their combination in soyabean (*Glycine max* (L.) Merrill), Journal of Plant Breed. Crop Science,2010:2:55-58.
8. Julia T, Renuka T, Nanita H, Jambhulkar S. Mutagenic effectiveness and efficiency of gamma rays in Indian mustard (*Brassica juncea* L. Czern and Coss). International Journal of Current Microbiology and Applied Sciences,2018:7(3):3376-3386.
9. Mitra PK, Bhowmik G. Studies on the frequency and segregation of induced chlorophyll mutantation in *Nigella sativa* L., Advance Plant Science,1999:12:125-129.
10. Kolar F, Pawar NV. Induced chlorophyll mutations in *Delphinium malabaricum* (Huth) Munz, Journal of Applied Horticulture,2011:13(1):18-24.
11. Swaminathan M.S. A comparison of mutation induction in diploids and polyploids. In: The use of induced mutations in plant breeding. Rad. Mut. Organ., FAO/IAEA Vienna, 1964, 619-641.
12. Goud, J. V. Induced polygenic mutation in hexaploid wheats. Rad. Botany,1967:7:321-331.
13. Gustafsson A. Induction of changes in genes and chromosomes II Mutations, environment and evolution Cold Spring. Harbour Symp Quant. Bio,1951:16:263-281.
14. Srivastava S, Verma R, Singh RR. Induced morpho floral variability in *Brassica campestris* L., Perspective in Cytology and Genetics,2006:12:473-478.
15. Rao MSS, Mendham MJ, Buzza GC. Effect of the apetalous flower character on radiation distribution in the crop canopy, yield and its components in oilseed rape (*Brassica napus*) DOI: https://doi.org/10.1017/S0021859600065278 Published online by Cambridge University Press: 2009.
16. Larmarque C. Conditions climatiques qui favorisent le processus nature deiacontamination du colza par le Sclerotinia sclerotiorum. Proc. 6th International Congress Paris France, 1883, 957-962.