Vol. 1, Issue III / April 2011, pp.202-204

Research Paper - Botony

Topic : Early Flowering and High Yielding Mutants In Ocimum sanctum Linn.

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Abstract

Early Flowering and High Yielding Mutants In Ocimum Sanctum Linn. were induced by physical (gamma rays) and chemical mutagens : SA (Sodium azide) and EMS (Ethylmethane sulphonate). The seeds were irradiated with 200,400,600 Gy gamma rays Seeds were also treated with SA (0.001%,0.002%,0.003%) and EMS (0.1%,0.2%,0.4). Population was screened carefully in M2 and M3 generations to isolate the mutants with early flowering and reduced maturation period and high yielding. Early flowering mutants were recorded in the M2 and M3 generation. The physical mutagen (gamma rays), as well as both chemical mutagens (SA and EMS) were found to induce high yielding mutants.

Introduction

The plants in the mutagen treated populations which commenced flowering about 15-20 days earlier than control plants were categorized as Early flowering. In the control plants, flowering commenced on 40-50 days after germination, whereas in the early flowering mutants, the flowering was found to start on 19th to 29th day after germination. The physical mutagen (gamma rays) as well as both chemical mutagens (SA and EMS) were found to induce high yielding mutants. These high yielding mutants were characterized by having considerably high seed yield, more number of branches and some of these were also taller than the control plants.

Keywords :

Physical and chemical mutagens Early flowering mutants, High yielding mutants, *Ocimum sanctum*.

Material and Methods

Dry seeds of *Ocimum sanctum Linn*. of uniform size and shape were treated in gamma cell with 60 CO as gamma ray source @ 100 Gy per minute at the Department of chemistry, RTM Nagpur University Campus, Nagpur. They were irradiated with 200, 400, 600 and 800 Gy doses of gamma rays. Seeds without irradiation served as control. Two chemical mutagens, sodium azide (E.Merck, Germany) and ethylmethane sulphonate (Sigma, USA) were used for inducing mutations. Seeds were presoaked for 5 and 10 hours in distilled water, surface dried with blotting paper and subjected to chemical mutagens.

The dry as well as pre. soaked seeds were treated with 20 ml aqueous solutions of 0.0, 0.001,0.002 and 0.003% Sodium azide (SA) and 0.00.,0.1.,0.2 and 0.4 % ethyl methane sulphonate (EMS) for 18 hours with uniform and continuous shaking on orbital shaker at 22 10C in 50 ml flask. All other conditions were similar. Treated seeds were thoroughly washed in running tap water, soaked in 50 ml of glass distilled water for 2 hours, again washed in running tap water and surface dried.

One hundred seeds of each treatment were sown in pots and the seedlings were transplanted in the field at sixth leaf stage. M2 and M3 populations were screened for early flowering and high yielding mutants.

Results and Discussion

The plants in the mutagen treated populations which commenced flowering about 15-20 days earlier than control pants were categorized as 'Early flowering'. In the control plants, flowering commenced on 40-50 days after germination, whereas in the early flowering mutants, the flowering was found to start on 19th to 29th day after germination. In some of the early flowering mutants, the number of branches and the weight of seeds were found to be more than control. The frequency of these mutants ranges from 0.28 to 0.27% in M2 and M3 0.38 to 0.26 in M3 in gamma ray treated population. In SA treated population, the frequency was 0.66 (Dry set 0.001%), 1.33 (5hpsw 0.001%) and 0.37% (10 hpsw 0.002%) in M2 generation and in M3 generation, it ranges from 0.8 to 0.49% (Dry set), 0.86 to 0.25% (5hpsw set), and 0.26% (10 hpsw 0.002%) respectively. In EMS treated population, the frequency was 0.19% (Dry set 0.1%), 0.16% (5 hpsw 0.4%) in M2 generation and in M3 generation, it ranges from 0.55 to 0.30 (Dry set), 0.53 to 0.8% (5hpsw set) and 0.19 to 0.31 (10hpsw set) respectively. All the three mutagens were observed to induce early flowering mutants with diferent frequencies. Early flowering mutants were also recorded in the M3 generation. (Table-1)

The physical mutagen (gamma rays), as well as both chemical mutagens (SA and EMS) were found to induce high yielding mutants. These high yielding mutants were characterized by having considerably high seed yield, more number of branches and some of these were also taller than the control plants. The plants height of these plants ranged between 66.8 to 103.1 cm and the number of branches varied from 18 to 38. The seed weight of per plants was 0.798 0.982 g. The frequency of these mutants was 0.28% in the gamma ray treated M2 population, and ranged between 0.74 to 0.33% in SA treatment. In EMS treated M2 population frequency was 0.19%. In the M3 generation also, the mutants were noted. (Table - 1)

Discussion

Earliness of flowering is one of the desirable characters, which can be reliably obtained in mutation experiments. In *Ocimum sanctum*, number of early flowering mutants have been obtained with the use of the gamma rays, SA and EMS. Early flowering mutants have been reported in barley by Hagberg (1969), Domini and Devraux (1970), Scholz (1971), Bansal (1971,1972), Ibrahim and Sharan (1974), Yameguchi et al (1974), Stephanov and Gorastev (1976), Hussein et al (1979, 1980) and Ukaiand and Yamashila (1980). Early flowering mutants in different plants were also reported. Marie (1970) with X- rays, gamma rays and EMS, Tanaka (1969) with gamma rays, Miah et al (1970) with gamma rays. Haq et al (1971) with gamma rays. Reddy and Reddy (1971, 1972) with gamma rays, neutrons and dES Ram (1974) with gamma rays, Ismachin and Mikaelsen (1976) with gamma rays, Kaul (1978) with gamma rays and Afsar et al. (1980) with SA very early and early flowering mutants have been reported by Kumar and Dubey (1998) in *Lathyrus* with gamma rays, individually, as well as, in combination with EMS or dES. George and Nayar (1973), in linseeds, have attributed earliness in flowering to the physiological changes caused by irradiation.

High yielding mutants were also obtained by physical and chemical mutagen treated population in *Ocimum sanctum*. Aastveit (1966) and Pollhamer (1966, 1967) reported high yielding mutants in *Hordeum vulgare*. Similar reports were made by Tanaka (1968), Saini and Sharma (1970), Pawar (1971), Kaul (1978), Ismail and Ahmad (1979) in *Oryza sativa* Jech (1966), Khvostova (1967), Mar'yushkin et al (1977), Siddiqui and Arain (1974), Sawhney and Sharma (1979), Sichkar et al (1980) and Siddiqui et al (1981) also reported high yielding mutants in *Triticum aestivum*. High yielding mutants were also reported by Kanaklata (1995) in *Cyamosis tetragonoloba*, Landge (2000) in *Brassica napus* and Girhe and Choudhary (2002) in *Lathyrus sativus*.

Acknowledgements

Authors thanks to Dr. K.H. Makde, Ex- Head, Department of Botany, RTM Nagpur University Campus, Nagpur having provided all possible resource material and facilities available in the department whenever required, without any hesitation. They thanks to Dr. R.P.Thakare for providing green house facilities. They also thanks to Prof A.P. Joshi, Ex- Head, Department of chemistry for making available the gamma cell facility for irradiation of seeds. The present work is a part of my Ph.D. Thesis.

References

- Aastviet K. (1966) Use of induced barley mutants in a cross breeding programme. Mutations in Plant Breeding IAEA, Vienna : 7 14.
- Afsar, A. M., Konzak, C. F., Rutgar, J. N. and Nilan R. N. (1980) Mutagenic effects of Sodium azide in rice Crop Sci. **20** : 663 668.
- Bansal, H.C. (1971) Induced polygenic variability and genetic advance for maturity in barley. In Proc. "*Int. Symp. use of Isotopes Radiant*" *Agric. Anim. Husbandry Res*. New Delhi : 146 153.
- Bansal, H.C. (1972) Induction of early dwarf mutants in barley. *Indian J. Genet. Plant Breed*. **32** : 203 206.
- Donini, B. and Deveraus M. (1970) Mutazioni indette per irraggia mento digarmetofiti in orzo. Genet. Agrar. **24** :208 209.
- George, K. P. and Nayar, G. G. (1973) Early dwart mutant in linseed induced by gamma rays. *Current Science*. **42** : 137 138.
- Girhe, S. and Choudhary, A. D. (2002) Induced morphological mutants in *Lathyras sativus. J. Cyotol Genetic* **3** (NS) : 1 6.
- Gustafsson, A.(1969) A study of induced mutations in plants. In "Induced mutations in *plants". Proc. Symp. IAEA*, Vienna : 9 31.
- Hagberg, A (1967) The use of induced mutations in practical barley breeding at Svalof. *Erwin Baur Ged*. Vol. **4**:147 154.
- Haq, M.S., Rahman, M.M., Mansur., A and Islam, R. (1971) Breeding for early, high yielding and disease resistant rice variances through induced mutations. In " *Rice Breeding with induced mutations . 111*" IAEA, Vienna 35 46.
- Hussein, H.A.S, Abdalla, M.M.F., Hindi, I, Ibrahim,

A.F. and Sharan, A.N. (1980) Biometric analysis of radiation induced early flowering barley mutants and associated characters. Egypt. J. Genet. Cytol. 9 : 145 166.

- Hussein, H.A.S., Abdalla, M.M.F. and Sharan, A.N. (1979) Genetic analysis of radiation induced early flowering mutants in barley. *Egypt. J. Genet. Cytol*. **3** : 106 116.
- Ibrahim, A.F. and Sharan, A.N. (1974) Studies on certain barley mutants in M3 and M4 after seed irradiation with gamma rays. *Z. Pflanzenzucht*. **73** : 44-57.
- Ismachin, M. and Mikaelsen, K. (1976) Early maturing mutants of rice breeding and their use in cross breeding programme. Result of work in Indonesia In " *Induced mutations on Cross Breeding*". IAEA, Vienna : 119 121.
- Ismail, M. A. and Ahmad S. S (1979) The possibility of solving an important breeding problem related to growing rice.
- Jech Z. (1966) Mutace u Psenice. In "*Vydalo Sdruzemi Slechtitelskych*". A Semena rskych podnikv V. Praze (Praha) : 185 192.
- Kanaklata (1995) Mutational studies in *Cyamopsis tetragonoloba* (L) Taub. Ph.D Thesis, Nagpur University, Nagpur, Maharashtra,India
- Kaul, M. L. H. (1978) Mutation and genetic studies in rice 1. Induced mutants of breeding value. *Genetika* (Belgrad) **10** : 63 77.
- Kaul, M. L. H. (1978) Mutation and genetic studies in rice 1. Induced mutants of breeding value. *Genetika* (Belgrad) **10** : 63 77.
- Khovostova, V. V. (1967) Mutagenic treatment of agricultural plants. *Erwin Baur Ged*. Vol. **4** : 21 27.
- Kumar, S. and Dubey, D. K. (1998) Induced morphological mutations in *Lathyrus sativus* L. *J. Cytol. Genet*. **33** (2) : 131 137.
- Landge, S.P. (2000) Induced mutations in *Brassica napus* (L) C. V. Westar. The Ph.D Thesis, Nagpur University, Nagpur, Maharashtra,India.
- Mar'yushkin, V. F., Shkvarnikar, P. K. and Sichkar, V. I. (1977) Induced variation of winter wheat yield components. Genetucam USSR. **13** : 1701 1709.
- Marie, R. (1970) Rice breeding with induced mutations in France. "*In Rice Breeding with Induced mutations II*" IAEA, Vienna : 21 24.
- Miah, A.J., Bhatti, I.M., Awan A. and Bari, G. (1970) Improvement of rice varieties by induced mutations to increase yield per acre and resistance to diseases and improve seed quality. In "*Rice Breeding with indued mutations II*" IAEA, Vienna : 69 76.
- Pawar, M. S. (1971) Present status of rice breeding, S. America. In " Rice Breeding with induced mutation III" IAEA, Vienna : 117 119.
- Pollhamer, E. (1966) Mutation experiments with summer barley, V. Breeding and Production value of the mutant of the variety MFB 104; Naveny termeles **15** : 217 226.
- Pollhamer, E. (1967) Importance of induced mutants in the research and improving of barley at Martonavasar. *Erwin Baur Ged*. **4** : 169 175.
- Ram, M. (1974) Useful induced mutations in rice. In "*Induced mutations for disease resistance in crop plants*." IAEA, Vienna : 161 164.
- Reddy, G.M. and Reddy T.P. (1971) Induced semidwarf Basmati rice mutant for commerce use. In Intern. Symp. On " *Use of Isotopes*". *Radial. Anim Husbandry Res*. New Delhi, IAEA : 237 241.
- Reddy, G.M. and Reddy, T.P. (1972) Induction of fine grain mutants in the rice variety IR 8. *Subrao Newslett*. **4** : 139 142.
- Saini, S.S. and Sharma, D. (1970) Radiation induced variation in rice improvement. *Indian J. Genet Plant Breeding*. **30** : 569 578.
- Scholz, F. (1971) Utilization of induced mutations in barley. *Barley Genet*. **2** : 94 105.
- Sichkar, V. I., Shkvarnikov, P. K., Mar'yushkin, V. F., Suvorinov, A. M. and Pod mobilriy, V. V. (1980) Investigation of the productivity of winter wheat mutants *Genetika USSR* **16** : 564 565.
- Siddiqui, K. A., Arain, A. G. (1974) Performance and selection for yield of wheat mutants derived from different cultivars. *Euphytica*. **23** : 585 - 590.
- Stephanov, T. and Gorastev, C. (1976) Use of induced mutagenesis and intervarietal hybridization in winter two rowed barley breeding. *Barley Genet*. **3** : 197 202.
- Tanaka S. (1969) Radiation induced rice with high protein content. *Instt. Radiat Tech News letter* **1** : 8.
- Ukaiand and Yamashita, A (1980) Induced mutation for resistance to barley yellow masaic virus. *Jpn .J. Breed*. **30** : 125 130.

Yamaguchi, H., Tano, H.S., Talara, A., Hirai, S., Hasegawa, k and Hiraki, M.(1974) Mutations in germinating barley seed by diethyl sulphate treatment at the cuterphase. In "*Polyploidy and Induced Mutations in Plants Breeding*". IAEA Vienna : 393 399