International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Induced Genetic Variability in Niger (Guizotia Abyssinica (L.F) Cass.) Under The Effect of Induced Mutagenesis

Dnyaneshwar K. Gunde[1], Prof. Sanjay A. Kamble[2]

[1,2]Research Centre in Botany, Department of Botany, Shri Muktanand College, Gangapur, Dist. Chh. Sambhajinagar (M.S), India.

Abstract:
Upon publication of the classic paper of muller (1927) and Stadler (1928), for the first time many researchers were acquainted with mutagenesis and started to use various chemical and physical mutagen to implant the large step mutations in array of plant systems. By this methodology a variety of plant strain had been produced which become important and worthful asset in number of plants which can be used for improvement of crop plants. Niger is an important oilseed crop in India with many nutritional values, in addition it can be cultivated in very less agricultural inputs. it provides a good commercial support to farmers. In African countries mostly this crop is cultivated due to its ability to grow in scarcity of water. India is the chief producer of Niger seed having second and fourth rank in world for its average and annual production respectively. But now days due to low yield/production in relation to required production it is not so popular among the growers ultimately the cultivation rate of Niger is getting declining. Mutation breeding is the important tool to induce mutation and produce a good strain of economical important strains of Niger. During present study a broad range of viable morphological and physiological mutants were observed in M1 generation of Niger [*Guizotia abyssinica* (L.f.) Cass.] raised from seeds treated with different concentrations of Sodium Azide and Ethyl Methane Sulfonate. Mutation obtained includes high seed germination percentage, chlorophyll deficiency sectors, leaf morphological, earliness, floral morphology and life cycle duration. The true breeding mutants were compared with its parent (Control) to assess its superiority. Mutant Shows higher germination percentage than control. mutation induced different chlorophyll deficiency sectors (Chlorina, Albina and xantha), changes in leaf morphology and flower morphology. The early mutant lines matured 10 days earlier than the parent variety

Keywords: Niger, *Guizotia abyssinica* (L.f.) Cass., Mutation Breeding, Oilseed

Introduction:

Niger *[Guizotia abyssinica* (L.f.) Cass.] is commonly known by many names in different parts of the country as Ramtil in Hindi, Karala in Marathi, Uhechellu in Kannada, Payellu in Tamil, Sarguza in Bengali, etc. Niger is considered as important oilseed crop in India with its surprising economic importance. as reviewed by Hilditch et al. (1994), Maiti et al., (1988) and Nagaraj, (1990a). In general, the composition of Niger seed is, seed oil 30-43% (mean 40%), protein 10-30% (20%), and soluble sugars, 7-18% (12%). The seed also contains 10% crude fibre and 4% ash. On the higher side, the seeds may contain up to 60% oil. Niger Seed are used in kitchen, medicine, cosmetic industries and as food for cattle,

as mentioned by Nagaraj and Patil (2004) Niger seed, its oil and cake have very good composition and quality. They are free from antinutrients. Oil is rich in essential fatty acids, while the cake and its protein are balanced in essential amino acids.

From past decades cultivation and production of Niger shows dramatic withering and the reason behind is low yielding cultivar as compared to its requirement, there is urgent need of improved cultivar. As Niger has very narrow genetic base traditional breeding techniques are not efficient for their improvement of Niger genome in short time period, mutation breeding can be a better alternative for the improvement of cultivars as it provides on large step of genetic change in less time period. Mutation breeding can achieve with the help of some chemical and physical mutagen like Sodium Azide, Ethyl Methane Sulfonate, Colchicine, X-Ray, Gamma ray, etc.

Material and Method:

The experimental plant material used in present investigation comprised a variety of Niger [*Guizotia abyssinica* (L.f.) Cass.] named Phule Karala (IGPN 2004-1). Seeds of this variety were obtained from Zonal Agricultural research station, Igatpuri, (M.S), India. Two chemical mutagens namely 1) Ethyl methane sulphonate (EMS) (CH3SO2OC2H5) manufactured by BLD Pharmatech, Hyderabad and 2) Sodium Azide (SA) (NaN3) manufactured by Molychem, Pvt Ltd. Badlapur was used in the present investigation to induce mutations in selected plant material.

The seeds were pre-soaked in distilled water for 6 hours. The mutagenic solutions were prepared freshly in aqueous medium at room temperature of 25±2°C prior to treatment. Pre-soaked seeds were immersed in the mutagenic solution and conical flasks were kept on electric shaker. The treatment was given for 6 hours with intermittent shaking. The volume of the chemical mutagenic solution used was three times as that of seeds so as to facilitate uniform conditions. The different concentrations used for chemical mutagenic treatment were 0.05% EMS, 0.10% EMS, 0.15% EMS and 0.1% SA, 0.2% SA, 0.3% SA. Immediately after the completion of treatment, the seeds were washed thoroughly under running tap water to remove excess of mutagens. All the mutagen treated seeds were immersed in distilled water for 2 hours. The post-soaked seeds were dried in folds of filter paper. Seeds soaked in distilled water for 12 hours served as control. 110 seeds were used for each treatment. 10 seeds from each treatment were kept on moist blotting paper in Petri plates to record germination percentage. The remaining 100 seeds of each treatment were sown in the field following randomized block design (RBD) with two replications each consisting of 100 seeds along with control for raising the M1 generation. The seeds were sown at a distance of 15 cm between the plants and 60cm between the rows. The field experiments were carried out in the experimental field at Barashiv, Ta. Vasamat, Dist. Hingoli.

Result:

Germination percentage

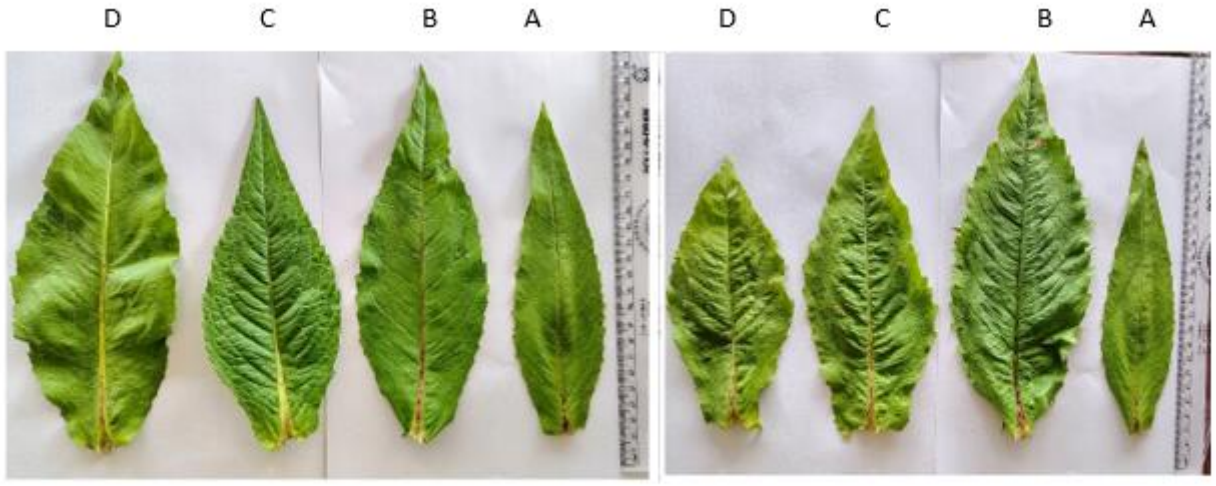
For EMS 0.05%, 0.10% and 0.15% shows germination percentage 56%, 59%, 71% respectively. Germination percentage of SA for 0.01%, 0.02% and 0.03% is 78%, 57% and 74%. control line shows 50% germination percentage. Highest germination percentage is shown by SA 0.01 line and lowest germination percentage were shown by EMS 0.05%.

Table 1- Effect of mutagens on seed germination percentage in M1 generation

Treatment	Concentration %	Germination %
Control	--	50
Ethyl methane sulphonate	0.05	56
	0.10	59
	0.15	71
Sodium Azide	0.01	78
	0.02	57
	0.03	74

Leaf morphological changes:

Various types of leaf morphological changes were recorded in M1 generation comparison with leaves in control. Variations in leaf size, shape, number of leaflets and margin were detected in all mutagenic treatments. Several plants exhibited large and unequal leaflets with notch at tip. Unifoliolate and bifoliolate leaves were seen in several treated plants. EMS treatments showed 7.80%,10.07% and 13.45% and SA treatment showed 5.20%, 7.24% and 9.48% frequency of plants carrying leaf morphological changes. Highest induction of leaf abnormalities was observed at 0.15% EMS treatment.



Sodium Azide

Ethyl Methane Sulphonate

*A- Control, B- 0.01%, C- 0.02%, D-0.03%

A- Control, B- 0.05%, C- 0.10%, D-0.15%

Table 2: Effect of mutagens on leaf morphological changes in M1 generation

Treatment	Concentration %	Leaf Morphological Changes %
Control	--	--
Ethyl methane sulphonate	0.05	7.80
	0.10	10.07
	0.15	13.45

Sodium Azide	0.01	5.20
	0.02	7.24
	0.03	9.48

Chlorophyll chimeras:

Chlorophyll chimeras were observed in all treatments. The percentage of chlorophyll chimeras increased with increasing concentration of mutagens in both of EMS and SA. All the chimeras were found to be affecting the leaflets partially and at the margins. Maximum frequency of chlorophyll chimeras was observed in the 0.15% treatment of EMS. Lowest frequency of chlorophyll chimeras was observed in the 0.01% treatment of SA.

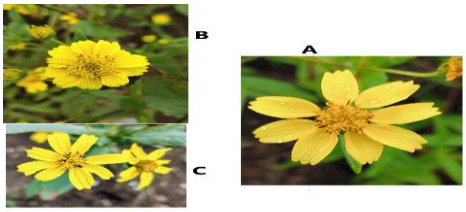
Chlorina Xantha Albina

Table 3: Effect of mutagens of frequency of plants carrying chlorophyll Chimeras in M1 generation

Treatment	Concentration %	Frequency of plants carrying chlorophyll chimeras (%)
Control	--	--
Ethyl methane sulphonate	0.05	1
	0.10	2
	0.15	6
Sodium Azide	0.01	1
	0.02	2
	0.03	4

Floral Morphological Changes:

Changes in floral morphology was seen in several plants. Flower showing change in size and number of ray florets was recorded, size of capitula also shows change. Some plant of EMS 0.05% treatment shows 11-12 ray florets instead of normal number of ray florets i.e. 8.



Survival Till Maturity:

Treatment	Concentration %	Survival of plant at maturity (%)
Control	--	96
Ethyl methane sulphonate	0.05	92.85
	0.10	96.61
	0.15	92.95
Sodium Azide	0.01	74.35
	0.02	98.24
	0.03	89.18

Discussion:

In the present study the variety of Niger namely Phule Karala (IGPN 2004-1) was used to induce genetic variability. For these study two chemical mutagens, namely EMS of different concentration such as 0.05%,0.10%,0.15% and SA of different concentration such as 0.01%, 0.02% and 0.03% were used. The M1 generation was raised and effect of these mutagens on different parameters like germination percentage, leaf morphological changes, chlorophyll chimeras, flower morphology changes and plants survival percentage were studied. Both the mutagens had shown Mixed pattern of stimulation/Inhibition was reported similar result were reported by Ganesh B. et.al (2013). Highest germination percentage is shown by SA 0.01 line and lowest germination percentage were shown by EMS 0.05% percentage. In all the treatments the leaves of plants exhibited variations in leaf lamina. Flower morphology shows increase in no of ray florets in EMS (0.05), size of ray floret also shown changes in many plants of all concentration. Survival of plant at maturity was found to be decreased at higher concentration of mutagens. The highest percentage was shown by SA (0.02%). The lowest percentage was shown by SA (0.01%).

References:

1. Hilditch, T.P., Sime, I.E., Zaky, Y.A.H. and Meara, M.L. The component acids of various vegetable fats, Journal of the Society Chemistry and Industry (London), 1944; 63(4): 112-114.
2. Imran Javed, Muhammad Ahsan, Hafiz Muhammad Ahmad2 and Qurban Ali1.Role of mutation breeding to improve Mungbean (Vigna radiata L. Wilczek) yield: An overview, Nature and Science 2016;14(1)
3. Ahloowalia, B.S., M. Maluszynski and K. Nichterlein.. Global impact of mutation derived varieties. Euphytica, 2004,135: 187-204.
4. Bhosale, U.P. and B.V. Hallale.. Gamma Radiation Induced Mutations in Black gram (Vigna mungo L. Hepper). Asian J. Plant. Sci. Res., 2011;1: 96 100.
5. Khatri, A., I.A. Khan, M. A. Siddiqui, S. Raza and G. S. Nizamani. Evaluation of high yielding mutants of Brassica juncea cv. S-9 developed through gamma rays and EMS. Pak. J. Bot., 2005;37: 279-284.
6. Nakagawa, Hitoshi. Induced mutations in plant breeding and biological researches in Japan. Abstract p.5. In: Book of Abstracts, FAO/IAEA International Symposium on Induced Mutations in Plants. 12-15 Aug., 2008, Vienna, Austria.
7. Munawar, K., S. Obaiduallah and Najibullah.. Induced genetic variability in lentil. Ind. J. Plant. Sci., 2006; 5: 682-692.
8. Kharkwal, M.C., Gopalakrishna,T., Pawar, S.E., Haq, M. Ahsanul. Mutation Breeding for Improvement of Food Legumes. p.194-221. In: M.C. Kharkwal (ed.) Food Legumes for Nutritional

Security and Sustainable Agriculture, Vol. 1. Proc. Fourth International Food Legumes Research Conference (IFLRC-IV), Oct. 18-22, 2008, New Delhi, India. Indian Society of Genetics and Plant Breeding, New Delhi, India (2008).

9. Kang, C.W., Shim, K.B., Hwang, C.D., Pae, S.B. Improvement of sesame crop through induced mutations in Korea. Abstract p.142. In: Book of Abstracts, FAO/IAEA International Symposium on Induced Mutations in Plants. 12-15 Aug., 2008, Vienna, Austria.