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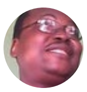

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(RESEARCH ARTICLE)

Effects of gamma irradiation on the agro-morphological traits of selected Nigerian eggplant (*Solanum aethiopicum* L.) accessions

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Abstract

The mutagenic effects of gamma irradiation on the agro-morphological traits of eggplant accessions were investigated to induce useful genetic variability for further breeding programme. Seeds of two eggplant (*Solanum aethiopicum* L.) accessions (MN/S/02/2015 and NHGB/09/132) were collected from the National Centre for Genetic Resources and Biotechnology (NAGRAB) Ibadan, Nigeria. The seeds were exposed to five different gamma irradiation doses (40 Gy, 60 Gy, 80 Gy, 100 Gy) and un-irradiated (0 Gy) as control at Centre for Energy and Research Training (CERT), Ahmadu Bello University, Zaria, Nigeria. The irradiated and the control seeds were planted in the Department of Plant Biology Garden in a Randomized Complete Block Design (RCBD) with four replicates each. All the plants were characterized on the basis of agro-morphological traits such as germination percentage, plant height, Number of leaves/plant, leaf length, number of branches, number of days to first flowering number of fruit/plant and fruit weigh. The results obtained showed significant differences ($P \leq 0.05$) on the agro-morphological traits with the highest number of leaves per plant (62.25), number of fruits per plant (39.50) and fruit weight (2.08g) in MN/S/02/2015 and highest number of leaves per plant (55.75), number of fruits per plant (28.75) and fruit weight (1.44g) in NHGB/09/132 obtained in 60 Gy. Therefore, 40 Gy and 60 Gy doses of gamma irradiation were obtained to be appropriate in creating beneficial traits in eggplant (*S. aethiopicum* L.) accessions.

Keywords: Accession; Agro-morphological; Eggplant; Gamma irradiation

1. Introduction

Eggplant (*Solanum aethiopicum* L.) is an economically important vegetable crop grown in tropical and temperate regions of the world. It belongs to the family Solanaceae and the genus *Solanum* with about 2,300 species known worldwide and about 25 species represented in Nigeria [1]. The plant is commonly referred to as garden egg in Nigeria, Gauta in Hausa, Afufa or Anara in Igbo and Igba in Yoruba.

It is recognized as the second most important Solanaceae fruit crop after tomato [2]. It is a good source of vitamins and minerals particularly iron, making its total nutritional value comparable with tomato. Due to

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importance, garden egg is an esteemed component of the Nigerian foods and native medicine that is either eaten raw or cooked. It is very common in mixed and rich dishes such as stews and soups [3], particularly in the Southern and Western parts of Nigeria [4].

Despite the great importance and uses of eggplant, the crop has been neglected and classified as low-status vegetables. It bitter taste nature also increases its disapproval especially among the young. The yield of the cultivated species has been reported to generally low with varying degree of acceptability. The low yielding ability of the crop has been attributed to lack of varietal replacement through development of hybrid and persistent use of traditional practices couple with the influence of environmental degradation [4].

As an alternative to natural mutation which takes several years to occur, creating mutation with different mutagens has contributed a lot to breeding programme in different aspects. It has been reported in many studies that genetic variability for several desired characters can be induced successfully through mutations and its realization for plant improvement programmes has been well established [5].

Mutation breeding by gamma irradiation is one of the most effective ways of inducing genetic variability in plants compared to other ionizing radiations because of their penetration ability [6] and also in the development of new varieties [7-8]. It generally influences plant growth and development by inducing cytological, genetical, biochemical, physiological and morphogenetic changes in cells and tissues of plants. Gamma irradiation has been used to produce a number of useful mutants and still shows great potential for improving vegetative plants [9]. It has become a new rapid method to improve the qualitative and quantitative traits of many crops in the last decade [10]. Large number of plant mutant varieties with desirable agro-morphological traits has been developed in closely related species by various authors using irradiation (5, 11]. This can also be of great value and benefit for the improvement of eggplant (*Solanum aethiopicum* L.) which is an important food crop in Nigeria. The improvement of the crop through creation of variability would give room for selection of high yielding variety with improved agro-morphological characters and increase its agricultural productivity. Therefore, this study was carried out to determine the effects of the gamma irradiation doses on the agro-morphological parameters of selected Nigerian eggplant (*Solanum aethiopicum* L.) accessions.

2. Material and methods

2.1. Seed Collection and irradiation

Seeds of two accessions of *Solanum aethiopicum* viz; MN/S/02/2015 and NHGB/09/132 were collected from National Centre for Genetic Resources and Biotechnology (NAGRAB) Nigeria. The viability of the seeds was tested before and after gamma irradiation according to the method described by [12]. Viable seeds of the accessions were irradiated using Cesium-137 source at Centre for Energy and Research Training (CERT), Ahmadu Bello University, Zaria, Nigeria. The doses include; 40Gy, 60Gy, 80Gy and 100Gy, with un-irradiated seeds (0Gy) as the control.

2.2. Experimental Design

A total of five viable irradiated and un-irradiated (control) seeds of each dose were planted in 7 litres experimental pots, filled to 5 litres mark with sandy-loamy soil. Each treatment were replicated four times and arranged in a Randomized Complete Block Design (RCBD), at the botanical garden of the Department of Plant Biology, Federal University of Technology Minna, Nigeria. All agronomic practices were carried out when necessary and the plants were monitored for morphological parameters.

2.3. Data Analysis

The agro-morphological parameters collected for the experiment were germination percentage, plant height, number of leaves per plant, leaf characteristics, number of branches per plant, days to first flower, fruit weight, seed weight (100 seed) and number of fruits per plant according to the methods described by [13-14] with minor modifications. The data generated were subjected to statistical analysis using Analysis of variance

(ANOVA) to test for significant differences and Duncan's multiple range test (DMRT) was used to separate the means where there were differences. All data analysis was carried out using the Statistical Package for Social Science version 20 at 5% level of significance.

3. Results and discussion

3.1. Effects of gamma irradiation on the morphological traits of *Solanum aethiopicum* (L.) accessions

The effects of gamma irradiation on morphological parameters are presented in table 1 below. The result showed that gamma irradiation significantly (P≤0.05) influenced the germination percentage of MN/02/2015 accession with the control seedling having the highest germination percentage (80.00%) and the least (70.00%) obtained in 80 Gy. However, there was no significant difference in the irradiated seedlings. Significant (P≤0.05) highest germination percentage (73.33%) in accession NHGB/09/132 was obtained in 60 Gy gamma ray and the least was recorded in 40 Gy. However, there was no significant difference (P>0.05) among 80 Gy (60.00%), 40 Gy (60.00%) and the control (63.33%) germination percentage.

Consistent highest plant height of 2.85cm, 18.75cm and 39.53 cm and lowest plant height of 1.68 cm, 13.40 cm and 33.90 cm were obtained in 60 Gy and 100 Gy respectively at week 4, 8 and harvest respectively in accession NHGB/09/132. Similarly, in accession MN/S/02/2015, highest plant height of 4.55cm and 43.98 cm were obtained in 60 Gy at week 4 and harvest respectively. The highest plant height (4.55 cm) obtained in 60 Gy at week 4 in accession MN/S/02/2015 were not significantly different (P>0.05) from the height of other doses (Table 1).

Consistent highest germination percentage and plant height recorded in low doses of 60 Gy in this study is in conformity to the report of Fardous et al., [15] who observed significant high plant height at low doses of gamma irradiation in *Moluccella laevis* L. Similarly, Kebeish et al., also observed significant high plant height at low doses of gamma irradiation in *Allium sativum* [16], in Soybean (*Glycine max* (L.) Mrr) [17] and in turmeric (*Curcuma longa*) [18]. These results showed that appropriate dose of gamma irradiation can significantly increase the height of the plant. This could be attributed to the stimulating effects of low doses of gamma ray on plant growth may be due to stimulation of cell division or cell elongation, alteration of metabolic processes that affect synthesis of phytohormones or nucleic acids [19]. In addition, high doses of gamma irradiation were reported to be harmful in several studies like that of Ramesh et al., who reported that higher doses of gamma irradiation (100 Gy) reduced plant height, number of leaves and branching capacity of mulberry (*Morus*) variety Kosen[20].

A significant variation (P≤0.05) in the leaf morphometrics was observed in all the doses with consistent decrease in leaf width with increase in irradiation doses were observed in both accessions with 40 Gy having the highest leaf width of 7.95 cm and 6.93 cm in accession MN/S/02/2015 and NHGB/09/132 respectively (Table 1). Similarly, significant highest (P≤0.05) leaf length in accession NHGB/09/132 was recorded in 40 Gy (10.50 cm) and in accession MN/S/02/2015 at 60 Gy with the value of 11.59 cm. This is similar to the findings of [18] who observed higher leaf length, leaf width and petiole length in varieties of turmeric (Curcuma longa).

Contrary to the result of Ramesh et al., who observed a decrease in the petiole length of mulberry (*Morus*) variety Kosen with increasing dose of gamma irradiation, inconsistent variation in petiole length with increase in irradiation doses were obtained with highest petiole length of 2.75 cm at a dose of 60 Gy in MN/S/02/2015 and 40 Gy in NHGB/09/132 [20]. These results showed that Lower doses of gamma irradiation have stimulatory effects on increase in length, number and width of leaves where as higher doses had inhibitory effects.

Table 1 Effects of gamma irradiation of on the germination, height and leaf morphometrics of eggplant (*Solanum aethiopicum* L.) accessions

Irradiation Dose (Gy)	Germination %	Height@WK4 (cm)	Height@WK8 (cm)	Height@Harvest (cm)	Leaf Length (cm)	Leaf width (cm)	Petiole Length (cm)
MN/S/02/2015							
0	80.00 ± 2.50^{b}	2.98 ± 0.33^{a}	23.27 ± 1.50^{b}	41.55 ± 0.64^{ab}	9.75 ± 0.57^{ab}	6.35 ± 0.44^{ab}	2.33 ± 0.13^{a}
40	$76.67 \pm 1.51_{ab}$	4.08 ± 0.66^{b}	23.13 ± 3.81^{b}	41.83 ± 2.61^{ab}	11.70 ± 0.91^{b}	7.95 ± 0.53^{c}	2.63 ± 0.30^{a}
60	77.78 ± 2.56^{ab}	4.55 ± 0.76^{b}	21.08 ± 4.47^{b}	43.98 ± 1.63^{b}	11.89 ± 1.07^{b}	7.65 ± 0.78^{c}	2.75 ± 0.21^{a}
80	70.00 ± 1.20^{a}	4.33 ± 0.27^{b}	17.50 ± 2.52^{a}	40.13 ± 3.17^{ab}	8.30 ± 2.37^{a}	6.65 ± 0.13^{ab}	2.53 ± 0.13^{a}
100	76.67 ± 1.52^{ab}	4.23 ± 0.60^{b}	18.83 ± 0.85^{a}	37.50 ± 1.07^{a}	9.13 ± 0.14^{ab}	5.50 ± 0.30^{a}	2.55 ± 0.19^{a}
NHGB/09/132							
0	63.33 ± 2.63^{a}	2.68 ± 0.26^{b}	18.20 ± 1.50^{b}	36.15 ± 2.91^{ab}	7.60 ± 0.45^{a}	4.53 ± 0.09^{a}	1.80 ± 0.16^{a}
`40	60.00 ± 2.73^{a}	2.70 ± 0.15^{b}	16.40 ± 3.68^{ab}	37.35 ± 1.45^{ab}	10.50 ± 0.11^{b}	6.93 ± 0.09^{c}	2.75 ± 0.16^{c}
60	73.33 ± 2.10^{b}	2.85 ± 0.22^{b}	18.75 ± 3.60^{b}	39.53 ± 0.94^{b}	10.00 ± 0.10^{b}	6.58 ± 0.03^{c}	1.90 ± 0.09^{a}
80	60.00 ± 2.00^{a}	2.30 ± 0.12^{b}	13.40 ± 2.08^{a}	35.70 ± 3.26^{ab}	8.75 ± 0.14^{a}	5.33 ± 0.13^{b}	2.30 ± 0.11^{b}
100	70.00 ± 1.21^{b}	1.68 ± 0.09^{a}	13.93 ± 0.83^{a}	33.90 ± 0.27^{a}	8.25 ± 0.17^{a}	5.30 ± 0.20^{b}	1.93 ± 0.05^{a}

Values are Means±Standard Error, followed by the same superscript(s) along the column are not significantly different at $p>0.05$ as tested by DMRT

Germination %- Germination percentage, Height@WK4 - Height at week 4, Height@WK8 – Height at week 8, Height Harvest - Height at harvest

3.2. Effects of gamma irradiation on the yield of *Solanum aethiopicum* (L.) accessions

The result of the effect of gamma irradiation on the number of days to first flowering is shown in table 2. The result revealed that in accession MN/S/02/2015, plants exposed to 40 Gy and 60 Gy doses of gamma irradiation flowered earlier (42.33 days and 42.67 days respectively) than plants exposed to other higher doses of gamma irradiation and the control. Similarly, in accession NHGB/09/132, plants exposed to 60 Gy gamma ray significantly (P≤0.05) flowered earlier (47.33 days) than other doses and the control.

A pronounced variation was observed in the number of leaves of mutant eggplant at the different doses of gamma irradiation. In accession MN/S/02/2015 (62.25), the highest number of leaves (62.25) was recorded in 60 Gy which was significantly different from other doses except 40 Gy (61.50). Similarly, a significant (P≤0.05) highest number of leaves per plant (55.75) were obtained in plants exposed to 60 Gy gamma ray in accession NHGB/09/132. The result reveals that gamma irradiation at low doses (40 Gy and 60 Gy) increase the number of leaves in eggplant. This result is however contrary to the findings of [21] who observed variations in the number of leaves of gamma irradiated groundnut (*Arachis hypogaea* L.) with 100 Gy having the highest number of leaves per plant [21]. These differences could be attributed to difference in the biochemical and physiological constituents of the plants. As reported by Lockhart et al., [22], the increased in leaf number and area provides an increase in the surface area for gaseous ex-change which considerable affect the process of photosynthesis. Therefore, higher number of leaves will definitely give room for more photosynthetic processes, hence increase the fruit production (Table 2).

Similarly, a significant variation was observed in most of the yield parameters such as number of fruits per plant, weigh of fruit and number of seeds per plant in all the doses. The highest weight of 100 seeds (1.39 g), number of fruits per plant (39.50), number of branches per plant (9.80) and fruit weight (2.08 g) was obtained in plants exposed to 60 Gy gamma ray in accession MN/S/02/2015. In accession NHGB/09/132, the highest weight of 100 seeds (1.05 g) was obtained in 40 Gy while the highest number of fruits per plant (28.75), number of branches per plant (4.75) and fruit weight (1.44 g) was obtained in plants exposed to 60 Gy gamma ray (Table 2).

This could be attributed to the increase in the number of leaf and leaf area obtained in the doses which increase the photosynthetic rate of the plants and result in high yield. This result is contrary to the findings of Gobinath and Pavadai [17] who observed significant moderate number of cluster per plant, number of seeds per plant and seed yield per plant in 50 KR (500 Gy) of gamma irradiated Soybean (*Glycine max* (L.) Mrr). Mudibu et al., on the other hand, observed a decrease in the yield parameters of M_1 Soybean (*Glycine max* (L.) Mrr) treated with 0.2 kGy (200 Gy) and 0.4 kGy (400 Gy) doses of gamma irradiation [23]. Khan and Wani reported a decrease of pod number at 0.4 kGy (400Gy) treatments and an increase at 50 kGy (500 Gy) without a change in the number of seed per pod of chickpea [24]. These differences could be due to the fact that gamma rays produce radicals that can damage and affect differentially plant morphology, anatomy, biochemistry, and physiology depending on the irradiation level and species of plants.

Table 2 Effects of gamma irradiation on the yield and yield components of (*Solanum aethiopicum* L.) accessions

Irradiation Dose (Gy)	Days to First Flowering	Number of Leaves per Plant	Weight of 100 Seeds (g)	Number of Seeds per plant	Number of Fruits per plant	Number of Branches per plant	Fruit weight (g)
MN/S/02/2015							
0	50.00 ± 0.58^{b}	41.25 ± 1.65^{a}	0.65 ± 0.14^{a}	110.50 ± 15.00^{b}	25.50 ± 1.85^{abc}	6.75 ± 0.48^{a}	2.00 ± 0.17^{a}
40	42.33 ± 0.33^{a}	61.50 ± 2.75^{b}	1.26 ± 0.30^{a}	109.25 ± 4.35^{b}	31.50 ± 5.44^{bc}	8.00 ± 0.41^{ab}	2.03 ± 0.06^{a}
60	42.67 ± 0.32^{a}	62.25 ± 1.31^{b}	1.39 ± 0.35^{a}	89.75 ± 6.49^{ab}	39.50 ± 8.54^{c}	9.80 ± 0.41^{b}	2.08 ± 0.14^{ab}
80	51.00 ± 1.00^{b}	54.50 ± 1.14^{ab}	1.26 ± 0.41^{a}	87.00 ± 3.70^{ab}	13.75 ± 0.85^{a}	6.50 ± 0.96^{a}	1.80 ± 0.18^{a}
100	56.67 ± 0.67^{c}	47.50 ± 2.50^{ab}	1.08 ± 0.31^{a}	76.75 ± 5.17^{a}	16.50 ± 4.44^{ab}	6.50 ± 0.87^{a}	1.68 ± 0.26^{a}
NHGB/09/132							
0	59.33 ± 0.33^{c}	40.00 ± 6.60^{ab}	0.77 ± 0.11^{a}	54.00 ± 7.43^{ab}	12.00 ± 2.86^{a}	4.00 ± 0.41^{ab}	1.42 ± 0.23^{b}
40	56.33 ± 0.33^{bc}	41.75 ± 5.11^{ab}	1.05 ± 0.12^{a}	83.75 ± 11.55^{c}	15.00 ± 4.20^{a}	3.75 ± 0.48^{ab}	1.30 ± 0.23^{b}
60	47.33 ± 1.20^{a}	55.75 ± 1.22^{a}	0.62 ± 0.16^{a}	57.00 ± 2.86^{b}	28.75 ± 1.11^{b}	4.75 ± 0.48^{b}	1.44 ± 0.03^{b}
80	51.33 ± 1.20^{b}	36.00±4.08a	0.81 ± 0.06^{a}	42.00 ± 3.19^{ab}	8.50 ± 2.40^{a}	4.50 ± 0.29^{ab}	0.70 ± 0.11^{a}
100	58.33 ± 0.88^{c}	35.22 ± 2.63^{b}	0.71 ± 0.09^{a}	35.00 ± 2.35^{a}	13.75 ± 1.31^{a}	3.25 ± 0.48^{a}	0.63 ± 0.07^{a}

Values are Means ± Standard Error, followed by the same superscript(s) along the column are not significantly different at $p>0.05$ as tested by DMRT.

4. Conclusion

This study has demonstrated that 40 Gy and 60 Gy significantly influenced the agro-morphological traits such as plant height, leaf characteristics, days to first flowering, number of leaves per plant and number of branches per plant. Therefore, for effective induction of useful genetic variability in eggplant (*Solanum aethiopicum* L.) accessions, low doses of gamma irradiation of 40 Gy and 60 Gy should be employed for its improvement and selection of desirable mutants for breeding purpose.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors of this article declared that there is no conflict of interest.

References

[1] Singh AK, Singh M, Singh AK, Singh R, Kumar S and Kalloo G. (2006). Genetic diversity within the genus *Solanum* (Solanaceae) as revealed by RAPD markers. Current Science, 90(5), 711-716.

[2] Knapp S, Vorontsova MS and Prohens J. (2013). Wild Relatives of the Eggplant (*Solanum melongena* L.: Solanaceae): New Understanding of Species Names in a Complex Group. PLoS ONE, 8(2), 85-96.

[3] Edem CA, Dounmu MI, Bassey FI, Wilson C and Umoren P. (2009). A comparative assessment of the proximate composition, ascorbic acid and heavy metal content of two species of garden egg (*Solanum gilo* and *Solanum aubergine*). Pakistan Journal of Nutrition, 8(5), 582-584

[4] Chinedu SN, Olasumbo AC, Eboji OK, Emiloju OC, Arinola OK and Schippers RR. (2008). Proximate and phytochemical analysis of *Solanum aethiopicum* L and *Solanum marcrocarpon* L. fruits. Research Journal of Chemical Sciences, 1, 63-71.

[5] Chopra VL. (2005). Mutagenesis: Investigating the Process and Processing the Outcome for Crop Improvement. Current Science, 89(2), 353-359.

[6] Moussa HR. (2006). Gamma irradiation regulation of nitrate level in rocket (*Eruca vesicaria* subsp. sativa) plants. Journal of New Seeds, 8 (1), 91–101

[7] Mohamad O, Mohd Nazir B, Alias I, Azlan S, Abdul Rahim H, Abdullah MZ, Othman O, Hadzim K, Saad A, Habibuddin H and Golam F. (2006). Development of improved rice varieties through the use of induced mutations in Malaysia. Plant Mutation Reports, 1, 27- 34.

[8] Animasaun DA, Morakinyo JA and Mustapha OT. (2014). Assessment of the effects of gamma irradiation on the growth and yield of *Digitaria exilis.* Journal of Applied Biosciences, 6164-6172.

[9] Predieri S. (2001). Mutation induction and tissue culture in improving fruits. Journal of Plant cell Tissue, and Organ Culture, 64, 185- 219.

[10] Desai AS and Rao S. (2014). Effect of gamma irradiation n germination and physiological aspects of pigeon pea (*Cajanus cajan* L.) Millsp) seedlings. International Journal of Research in Applied, Natural and Social Sciences, 2(6), 47-52.

[11] Falusi OA, Daudu OAY and Teixeira da Silva JA. (2012). Effect of exposure time of fast neutron irradiation on growth and yield parameters of *Capsicum annum* and *Capsicum frutescens,* African Journal of Plant Science. 6(9), 251-255.

[12] Maity JP, Kar S, Banerjee S, Chakraborty A and Santra SC. (2009). Effects of gamma irradiation on long-storage seeds of *Oryza sativa* (cv. 2233) and their surface infecting fungal diversity. Radiation in Physical Chemistry, 8(6), 34-60.

[13] Ihtizaz H, Shakeel AJ, Muhammad A, Sadar US and Muhammad A. (2015). Genetic Variability in Eggplant for Agro-Morphological Traits. Science, Technology and Development, 34, 35-40

[14] Falusi OA, Muhammad ML and Teixeira da Silva JA. (2015). Vegetative improvement of three Nigerian Sesame varieties after FNI treatment. Journal of Plant Development Sciences, 22, 77-81.

[15] Fardous AM, Mohammed EE and Kafr E. (2013). Effects of Gamma Radiation on Germination, Growth Characteristics and Morphological Variations of *Moluccella laevis* L. American-Eurasian Journal of Agriculture & Environmental Science, 13 (5), 696-704

[16] Kebeish R, Deef H and El-Bialy A. (2015). Effect of Gamma Radiati on Growth, Oxidative Stress, Antioxidant System, and Alliin Producing Gene Transcripts in *Allium sativum.* International Journal of Research Studies in Biosciences, 3(3), 161-174.

[17] Gobinath P and Pavadai P. (2015). Effect of Gamma Rays on Morphology, Growth, Yield and Biochemical Analysis in Soybean (*Glycine max* (L.) Merr.). World Scientific News, 23, 1-12.

[18] Ilyas S and Naz S. (2014). Effect of gamma irradiation on morphological characteristics and isolation of curcuminoids and oleoresins of *Curcuma longa* L. Journal of Animal and Plant Science, 24(5), 1396-1404.

[19] Hanan J and Prusinkiewicz P. (2008). Foreword: studying plants with functional structural models. Functional Plant Biology, 35, 1-3.

[20] Ramesh HL, Yogananda VN and Murthy M. (2012). Effect of different doses of gamma radiation on growth parameters of Mulberry (Morus) variety Kosen. Journal of Applied and Natural Science, 4 (1), 10-15

[21] Tshilenge- Lukanda L, Kalonji- Mbuyi A, Nlongolo KKC and Kizungu RV. (2013). Effect of Gamma Irradiation on Morpho- Agronomic Characteristics of Ground nut (*Arachis hypogea* L.). American Journal of Plant sciences, 4, 2186- 2192.

[22] Lockhart BEL, Irey M and Comstock JC. (1996). *Sugarcane bacilliform virus, Sugarcane mild mosaic virus* and sugarcane yellow leaf syndrome. *In:* Croft BJ, Piggin CM, Wallis ES *and* Hogarth DM *(Eds),* Sugarcane Germplasm Conservation and Exchange. Report of an International Workshop, Brisbane, Queensland, Australia, 28–30

[23] Mudibu J, Nkongolo KKC, Kalonji-Mbuyi A and Kizungu RV. (2012). Effect of Gamma Irradiation on Morpho-Agronomic Characteristics of Soybeans (*Glycine max* L.). American Journal of Plant Sciences, 3, 331-337.

[24] Khan S and Wani MR. (2005). Genetic variability and correlations studies in chickpea mutants. Journal of Cytology and Genetics, 6(2), 155-160.

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