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Novel LPA (Low Phytic Acid) Mutant in Pigeonpea (*Cajanus cajan* (L.) Millsp.)

S. P. Giri
Post-Graduate Department of botany, Padmashri Vikhe Patil College of Arts, Science and Commerce
Pravaranagar, At-Post- Loni kd., Tal-Rahata, Dist-Ahmednagar (MS),
PIN 413 713.
Email: sanjaygiri2005@gmail.com

ABSTRACT
Phytic acid is considered to be an antinutritional substance in human diets because it binds mineral cations and reduces their bioavailability. Pigeonpea [Cajanus cajan (L.) Millsp] is one of multipurpose legume of grown in many states if India for important source of protein, carbohydrate, minerals and B-complex vitamins particularly in vegetarian diet. Isolation of low phytic acid content (P) in seeds is a desired goal of genetic improvement in several crops. Objective of the present investigation has been to induce genetic variability in pigeonpea especially both quantitative and qualitative characters. This would help in improving the nutritional quality of pigeonpea (ICPL-87) through mutation breeding by employing physical mutagen like Gamma rays which have been used in the present programme. The present investigation reports induction of low phytic acid mutant in Pigeonpea as a result of treatment with 300Gy and 400Gy gamma rays. These mutants are named as lpa mutants. These mutants were characterized by significant decrease in phosphorus content as compare to its control counterpart. Result indicate that the genotypes of pigeonpea with low phytic acid content could be identified and used in breeding program to improve their nutritional value and utilization.
***Key Words**: Novel, Pigeonpea, Gamma rays, Phosphorous, Phytic acid.*

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INTRODUCTION

Pigeonpea [*Cajanus cajan* (L.) Millsp] is one of multipurpose legume of Maharashtra grown in Kharif season. Pigeonpea is an economic source of not only protein but of carbohydrate, minerals and B-complex vitamins particularly in vegetarian diet [10]. Phytic acid (myo-inositol 1,2,3,4,5,6-hexakisphosphate) is an abundant component of plant seed grains and is deposited in protein bodies as a mixed salt of mineral cations, such as K^+, Mg^{2+}, Ca^{2+}, Zn^{2+}, and Fe^{3+} [12]. Low-phytic acid mutants have used in genetic breeding, but it is not known what genes are responsible for the low-phytic acid phenotype. Although phytic acid as an antioxidant is suggested to have potential functions of reducing lipid peroxidation and some protective effects, phytic acid is considered to be an anti nutritional substance in animal feed and reduces human diets because it binds mineral cations and reduces their bioavailability [14]. Additionally, Phytic acid is a strong chelating agent that can bind metal ions, reducing availability of Fe, Zn, and Mg, therefore reducing phytic acid content would increase nutritional value [4]. Isolation of reduced phytic acid content in seeds is a desired goal of genetic improvement in several crops including maize, rice, barley, wheat, soybean and pigeonpea. Pigeonpea (*Cajanus cajan* L.) is important grain legume of Indian subcontinent and good source of protein, minerals and vitamins for million of people in the world. Phytic acid content (mg/g) is 12.7 in pigeonpea, on an average, phytic acid constituted 78.2 percent of the total phosphorous content [2]. In the present investigation an effort was made to induce low phytic acid (=Low Phosphorous) mutant in pigeonpea by employing Gamma rays.

MATERIAL AND METHODS

Plant Material: Dry dormant seeds of Pigeonpea (*Cajanus cajan* L.) ICPL-87 cultivar (Moisture content 10-11%) procured from Pulse Improvement Division of Mahatma Phule Krushi Vidyapeeth Rahuri were irradiated with 100, 200, 300 and 400Gy gamma rays from the source of CO^{60} from institute of Science, Aurangabad. 250 treated seeds from each treatment including control were sown on the same day in well-prepared seed beds in the field. The seeds were sown in randomized block design (RBD) in rows of

5M long and 60 cm between rows, at a spacing of 25 cm between plants, in the experimental fields of Padmashri Vikhe Patil College, Pravaranagar during the Kharif 2016.
Seeds from M_1 progeny were harvested separately and carefully from each treatments as well as control and sown to raise M_2 progeny in Kharif 2017. In M_2 progeny plants were carefully screened for the occurrence of any novel, morphological mutants. The seeds of twelve isolated morphological mutants (Table.1) were also analyzed in laboratory for Phosphorous (P) content by Vanadomolybdate yellow colour method as described by Bhargava and Raghupathi [1].

RESULT

In M_2 generation twelve morphological mutant isolated viz. Bold seeded mutant (BSM), Bushy mutant (BM), Coffee colour mutant (CCM), Dwarf mutant (DM0, Early mutant (EM), Energy saving mutant (ESM), High yielding mutant (HYM), Late mutant (LM), Spreading mutant (SM), Tall mutant (TM), Vegetable type mutant (VTM) and White Seed mutant(WSM). Out of this Energy Saving mutant (ESM) and Vegetable type mutant (VTM) shows reduced phosphorous content and named as lpa mutants (Table.1). These mutants were isolated from M_2 progeny of 300Gy, and 400Gy gamma rays administered pigeonpea cultivar respectively.

Table: 1. Phosphorous content of viable mutants in M_2 in Pigeonpea

Sr. No	Name of Mutant	Phosphorus %	Shift mean
1.	Control	0.26	0.00
2.	BSM: Bold seeded mutant	0.38	0.12
3.	BM: Bushy mutant	0.27	-0.11
4.	CCM: Coffee colour mutant	0.28	0.01
5.	DM: Dwarf mutant	0.23	-0.05
6.	EM: Early mutant	0.32	0.09
7.	**ESM: Energy saving mutant**	0.14*	-0.18
8.	HYM: High yielding mutant	0.32	0.18
9.	LM: Late mutant	0.26	-0.06
10.	SM: Spreading mutant	0.28	0.02
11.	TM: Tall mutant	0.34	0.06
12.	**YTM: Vegetable type mutant**	0.13*	-0.21
13.	WSM: White Seed mutant	0.22	0.09
CV % : 3.68		CD 1% : 0.021	
SE ± 0.0054		CD 5% : 0.015	
*Significant decrease in Phosphorous content			

DISCUSSION

The lpa mutant of Pigeonpea exhibits a 40% reduction in seed phytic acid with an equivalent increase in inorganic phosphorus. It is indirectly responsible to decrease in phytic acid content. Differences observed among morphological mutant and corresponding control plants is shown in the table. Similar results of low phytic acid mutants are also reported by, Raboy *et al*., [7,8] in maize, Li *et al*., [5] in Barley, Shi *et al*., [12], Nguyen Thi Lang *et al*., [6] in rice, and Raboy [7], Tambe, [13] in Soybean, Sangle [11] in Pigeonpea and Giulia Borlini *et al*. [3] in maize. Result indicate that the genotypes of pigeonpea with low phytic acid content could be identified and used in breeding program to improve their nutritional value and utilization.

CONCLUSION

From the above investigation it is concluded that the genotypes of pigeonpea with low phytic acid content could be identified and can be successfully used in breeding program to improve their nutritional value and utilization.

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