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Biochemical Molecular Characterization of Finger Millet [Eleusine coracan L. (Gaertn)] Genotypes

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ABSTRACT

Millets are small-seeded cereal grains consumed as food by millions of people throughout the world. It has been perceived as a potential "super cereal" being one of the most nutritious among all major cereals. Biochemical as well as molecular parameters were analyzed of 12 finger millet genotypes. The range of biochemical parameters like moisture content (4.9-7.5), total soluble sugar (2.89-3.94), reducing sugar (2.98-2.12), non-reducing sugar (0.28-1.65), crude protein (5.0-8.1), free amino acid (0.38-0.82), oil content (0.99-2.15), phenol (0.21-0.44), flavonoid (1.59-3.25), antioxidant (0.98-1.60), tannin (0.36-0.61) in per cent were found. Minerals such as Ca (158.60-220.15), Mg (1008-1236), Zn (14.20-7.27), Fe (11.3-22.5), Mn (32.5-41.1), Cu (2.71-4.12), K (1121-1910) were observed in ppm. Different antinutritional factors were analyzed like phytic acid, trypsin inhibition and oxalate from finger millet were range 237.6-324.5 mg/100g, 190.6-258.3 TIU/gm, 19.80-26.41 mg/100 respectively.

Keyword: millet, sugar, phenol, antioxidant, oil, tannin

INTRODUCTION

India is the largest producer of many kinds of millets. Realizing the nutrient composition of millets, they are now considered nutritious grains. They are quite important in areas of their production as dryland crops and most often cultivated as a rainfed crop on marginal or poor soil providing staple food for people of the region. Millets are small seeded with different varieties such as pearl millet (*Pennisetum glaucum*), finger millet (*Eleusine coracana*), Kodo millet (*Paspalum setaceum*), proso millet (*Panicum miliaceum*), foxtail millet (*Setaria italic*), little millet (*Panicum sumatrense*), and barnyard millet (*Echinochloa utilis*).

Finger millet (*Eleusine coracana*) belongs to the family Poaceae. It is also known as 'ragi' in India is an important staple food for people belong to the low socio-economic group. It is the third most important minor millet in India. It is also known as African millet. (Brich et al. 2007). It has been perceived as a potential "super cereal" being one of the most nutritious among all major cereals (National Research Council, 1996). Finger millet contains about 5-8% protein, 1-2% ether extractives, 65-75% carbohydrates, 15-20% dietary fiber, and 2.5-3.5% minerals. It is also rich in iron and fiber, making this crop more nutritive as compared to other most used cereals. Currently, molecular markers have been used as an efficient tool to assess the genetic variation and relatedness among cultivars. Various molecular markers such as RAPD, RFLP, AFLP, ISSR, and SSR, etc. have been used in the genetic diversity analysis in different crop species (Ramakrishnan et al. 2016).

MATERIALS AND METHODS

The present experiment was carried out in Biochemistry Department, B. A. Collage of Agriculture, Anand Agricultural University, Anand. The Finger millet genotypes (GPU-67, GN-8, PR-202, GPU-45, VL-376, PHULE NACHANI, PHULE KESARI, VR-936, GNN-7, VL-324, GPU-66 and KOPN-235) was obtained from Department of Genetics and Plant breeding, Anand Agricultural University, Anand. The recommended methods of the various parameters were adopted to determine the various biochemical and molecular characterization.

Biochemical parameters such as moisture (4), total soluble sugars (5), reducing sugars (6), non-reducing sugars (7), crude protein (8), free amino acids (9), oil (10), phenol (4), flavanoid (4), antioxidant activity (4), phytic acid (11), trypsin inhibitor (12), oxalate (13), tannin (13), , Minerals [Ca, Mg, Zn, Fe , Mn, Cu, K] (4).

RESULT AND DISCUSSION

Biochemical parameters analysis of all Finger millet genotypes was done with the seed and the results are shown in Table 3.1.

Moisture percentage was remarkably higher (7.5 %) in the genotype GN-8 showed and marked low value with the genotypes, GNN-7 (6.3 %). The finding obtained in the study by Balasubramanian, and Viswanathan (2010) reported the coefficient of static friction, coefficient of internal friction, and grain hardness were determined for foxtail millet, little millet, kodo millet, common millet, barnyard millet, and Finger millet the moisture content range was from 11.1 to 25% db. The total soluble sugar content of Finger millet genotypes varied significantly and ranged from 2.89 – 3.94 % among genotypes. Maximum value found in the genotype GPU-67 (3.94 %) and minimum value found in the genotype GPU-66 (2.89 %). Wankhede *et al*., (1979) reported that all the millets contain total soluble sugars in the ranse of 0.46 to 0.69 %.

Finger millet is rich in amino acids which are vital in the normal functioning of the body and are essential for repairing body tissues. The free amino acid content of Finger millet genotypes was varied significantly among the genotypes in the range of 0.45 - 0.82 %. The highest and lowest value observed in the genotypes was GNN-7 (0.82 %) and KOPN-235 (0.38 %), respectively. Glew et al., (2008) reported from this investigation the Finger millet (Eleusine coracana) is a staple food of some communities. Interested in amino acids, fatty acids, and minerals that are also cultivated in the same mountainous savannah of Nigeria. The black Finger millet is a good source of the amino acid, essential fatty acid, and the minerals. Gupta and Shrivastava (2015) found that the nutritional properties of different hybrid varieties of Echinochloa frumentacea L. (Sanwa). The amino acid content was ranged from 0.08 to 0.522 %. Oil content was analyzed by Poonia *et al*., 2012 found in the range of 0.74 %. It was observed in the Finger millet genotypes in the range between 0.99 - 2.15 %. Reducing and non-reducing sugar content of Finger millet genotypes varied significantly with the higher value of reducing sugar in genotype VL-324 (2.98 %) and for non-reducing sugar, in the genotype GPU-67 and KOPN-235 (1.65 %) and the lower values of the both reducing and non-reducing sugar were observed in genotype KOPN-235 was 2.12 % and 0.28 % in the genotype PHULE NACHANI. Radhey and Singh (2018) also reported that reducing sugar was found in the range (1.27 to 1.72 %) and non-reducing sugar between (1.02 to 2.65 %). Protein

plays a vital role in all living organisms and is important for muscles and tissues and it was in the range of 5.0 - 8.1 %. GNN-7 genotype having significantly higher amount of protein (8.1 %) and KOPN-235 the genotype having the lowest amount of protein (5 %). The high amount of protein present in white seeded genotypes were GNN-7 (8.1 %) and VR-936 (7.8 %). The protein content varies widely and that the white-grain varieties have higher protein than the brown-grain varieties findings this lends support to the of Virupaksha *et al*., (1975).

The phenol content was significantly affected and was in the range of 0.21 - 0.44 % in Finger millet genotypes. Significantly higher and lower phenol content was observed in the genotypes PR-202 (0.44 %) and GNN-7 (0.21 %), respectively. The flavonoid content was significantly affected and was in the range of 1.59 - 3.25 % significantly. The higher and lower value of antioxidant content was in genotypes PR-202 (1.60 %) and GNN-7 (0.98 %), respectively. Phytic acid was recorded in the range of 324.5-237.6 mg. Wadikar *et al*. (2006) matched with result that the average phytate was 224.6 to 194.9 mg 100 g^{-1} and effect of variety and processing on anti-nutrients in Finger millet. The trypsin inhibitor was differed significantly among Finger millet genotypes ranging from 236.1-190.6 TIU g^{-1}. Nakarani et al., (2021) studied that phytochemical profiling for phytic acid, tannins, oxalate, and trypsin inhibitor which were observed in the range of 210.75–

Table 3.1: Biochemical parameters analysis from Finger millet genotypes

GENOTYPE	Moisture (%)	Total soluble sugars (%)	Reducing sugars (%)	Non reducing sugars (%)	Crude protein (%)	Free amino acids (%)	Oil (%)	Phenol (%)	Flavonoid (%)	Antioxidant activity (%)	Phytic acid (mg 100 g−1)	Trypsin inhibitor (TIU g^{-1})	Oxalate (mg 100 g−1)	Tannin (%)
GPU-67	7.4	3.94	2.3	1.65	5.7	0.39	1.93	0.29	1.69	1.42	249.1	210.4	26.41	0.36
GN-8	7.5	3.93	2.45	1.48	6.3	0.53	1.42	0.31	1.77	1.15	255.6	190.6	19.8	0.47
PR-202	6.5	3.85	2.49	1.36	6.7	0.74	1.94	0.44	3.25	1.6	261.3	237.9	23.34	0.53
GPU-45	6.4	3.19	2.77	0.41	5.5	0.59	2.13	0.32	1.91	1.51	246.8	221.6	25.13	0.61
VL-376	7.1	2.92	2.65	0.28	7.5	0.67	2.15	0.35	1.78	1.4	259.6	207.6	22.09	0.57
PHULE NACHANI	5.4	3.15	2.68	0.47	7.4	0.52	1.84	0.33	2.74	1.21	241.9	231.6	24.56	0.4

PHULE KESARI	5.6	3.89	2.41	1.48	7.6	0.53	1.96	0.37	1.92	1.47	237.6	258.3	20.9	0.48
VR-936	6.3	3.41	2.57	0.84	7.8	0.76	1.59	0.25	1.66	1.1	311.2	243.9	23.54	0.51
GNN-7	4.9	3.81	2.92	0.89	8.1	0.82	1.23	0.21	1.59	0.98	324.5	244.4	25.7	0.39
VL-324	5.5	3.48	2.98	0.5	7.2	0.45	1.49	0.3	1.82	1.31	253.7	227.6	24.7	0.45
GPU-66	6.9	2.89	2.54	0.35	6.9	0.46	1.12	0.34	1.87	1.55	269.8	215.8	23.72	0.37
KOPN-235	6.6	3.78	2.12	1.65	5	0.38	0.99	0.27	3.02	1.57	301.2	236.1	22.4	0.42
S. Em.	0.12	0.06	0.04	0.04	0.08	0.009	0.04	0.01	0.03	0.02	11.74	2.81	1.27	0.01
CD (P=0.05)	0.36	0.19	0.12	0.12	0.23	0.03	0.1	0.02	0.08	0.06	34.27	8.2	3.7	0.01
CV %	3.37	3.17	2.85	7.36	1.94	2.76	3.74	3.63	2.29	2.88	7.59	2.14	9.34	1.87

302.75, 340.00–500.00, 19.80–26.23 mg 100 g^{-1} and 207.35–234.23 TIU g^{-1}, respectively. Oxalate content of Finger millet represented in the Table 4.6 was in the range of 26.41-19.80 mg per 100gm which was varied significantly. Tannin content was observed in the Finger millet genotypes varied significantly with the range of 0.36 – 0.61 %.

CONCLUSION

Overall, it can be concluded that the maximum moisture and non-reducing sugars contents were recorded in seeds of GPU-66 while in case of crude protein and free amino acids were observed higher in GNN-7 genotype. However, the total phenol, flavonoid and total antioxidant activity was noticed higher in the genotype PR-202. The minerals such as Mn, Cu as well as K were observed higher in seeds of GPU-67.

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