Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(5): 2636-2638
Received: 15-06-2020
Accepted: 20-07-2020

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Studies on performance of browntop millet indigenous collections for grain yield and nutritional traits

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Abstract
In the present study, 30 browntop millet indigenous collections were investigated for grain yield and various quality traits, *viz.*, protein content, calcium content, iron content, zinc content and crude fibre content. The grain yield plant^{-1} ranged from 4.74 g to 20.38 g with a mean of 12.13 g, protein content from 8.93% to 19.33% with a mean of 10.72%, calcium content from 8.00 mg 100g^{-1} to 33.00 mg 100g^{-1} with a mean of 13.97 mg 100g^{-1}, iron content from 3.70 mg 100g^{-1} to 15.32 mg 100g^{-1} with a mean of 8.86 mg 100g^{-1}, zinc content from 1.36 mg 100g^{-1} to 2.8 mg 100g^{-1} with a mean of 2.11 mg 100g^{-1} and crude fibre content from 6.5% to 9.87% with a mean of 8.06%. Among the genotypes studied, five best yielders that recorded significantly higher grain yield plant^{-1} over the mean (IC 617961, IC 617957, IC 613559, IC 617956 and 28 bijapur collection) were estimated for nutritional traits. For iron content IC 613559, IC 617957, IC 617961 and 28 bijapur collection, for zinc content IC 617956, IC 617957, IC 617961 and 28 bijapur collection and for crude fiber content IC 617956 and IC 617961 recorded significantly higher levels over the mean. On the other hand the genotypes IC 613556 and IC 613552 recorded significantly higher levels of protein content and genotypes IC 617952 and IC 617960 recorded significantly higher levels of calcium content.

Keywords: Performance, browntop, bijapur, nutritional traits

Introduction
The gradual change in climatic conditions, fast depletion of natural plant resources and increasing population are the major global concerns in today's context which make it necessary to explore the possibilities of using newer indigenous plant resources that are stress tolerant such as millets to ensure food security. There are many indigenous plant species still lying unexplored and underexploited. Browntop millet is one such underutilised millet which is neglected by the current monocrop based agriculture system.

Browntop millet (*Brachiaria ramosa* (L.) Stapf.) is one of the rare crop among millets belonging to family Poaceae. It is locally called as 'anda korra' in Telugu and 'korale' in Kannada. It grows well in the dryland tracts of Karnataka-Andhra Pradesh border areas, covering regions of Tumkur, Chitradurga and Chikkaballapura districts in Karnataka (Sujata *et al.*, 2018) [8] and Anantapuram district in Andhra Pradesh. It is primarily used as a food and fodder crop in India. It appears to have been a major staple crop in the late prehistory of the wider region of the deccan (Fuller *et al.*, 2004) [1]. In several parts of India, browntop millet is known by local names which translate to "illegal wife of little millet [*Panicum sumatrense*]," reflecting its tendency to grow within the fields of little millet as a mimic weed (Sakamoto, 1987). It is the most inexpensive crop and can be grown even in less fertile soils like sandy loam. Its grains are rich in protein (11.5 g 100g^{-1} of grains), dietary fibre (12.5 g 100g^{-1} of grains) and minerals (4.2 g 100g^{-1} of grains) (Indian Institute of Millets Research, 2019) [2]. Hence it not only provides an answer to climate change crisis but also stands as the best solution to deal with malnutrition among the rural poor and lifestyle diseases among the urban and semi-urban regions due to its high nutritional value (Reddy and Prasad, 2017) [5]. Inspite of having high micronutrient potentiality, storage stability and fodder quality it is grown in negligible area. So, there is a need to explore the potentiality of the crop. Hence, here an effort is made to identify suitable high yielding and good quality genotypes.

Material and Methods
The experimental material consists of 30 browntop millet indigenous collections which were evaluated during *kharif*, 2019 at Regional Agricultural Research Station, Lam, Guntur, Andhra Pradesh. Thirty browntop millet indigenous collections were laid out in RCBD design and the seed samples of these collections was used for estimation of grain nutrients *viz.*, protein

content (%), calcium content (mg $100g^{-1}$), iron content (mg $100g^{-1}$), zinc content (mg $100g^{-1}$) and crude fibre content (%). Protein content was estimated using Micro Kjeldhal Distillation Method (Sadasivam and Manickam, 1996) [6]. Calcium content was estimated using Versenate titration method (Jackson, 1967) [3]. Iron content and zinc content in the grain were estimated with the help of Atomic Absorption Spectrophotometer (AAS) as per Tandon (1999) [9]. While, crude fibre content was determined as per the method suggested by Maynard (1970) [4].

Results and Discussion

In the present investigation, grain yield and five quality traits in 30 browntop millet indigenous collections were assessed for significance based on mean performances and the data was interpreted to draw credible conclusions.

Grain yield $plant^{-1}$ ranged from 4.74 g (IC 613557) to 20.38 g (IC 617961) with a mean of 12.13 g, protein content (%) from 8.93% (IC 613560) to 19.33% (IC 613556) with a mean of 10.72%, calcium content (mg $100g^{-1}$) from 8.00 mg (IC 617954 and IC 617955) to 33.00 mg (IC 617952) with a mean of 13.97 mg, iron content (mg $100g^{-1}$) from 3.70 mg (IC 613547) to 15.32 mg (IC 617957) with a mean of 8.86 mg, zinc content (mg $100g^{-1}$) from 1.36 mg (IC 613555) to 2.8 mg (IC 606693, 28 Bijapur collection) with a mean of 2.11 mg and crude fibre content (%) from 6.5% (IC 617955) to 9.87% (IC 613554) with a mean of 8.06% among the genotypes studied.

The details of nutritional parameters and grain yield of 30 browntop millet genotypes under study are presented in Table 1. The genotypes that had significantly higher grain yield $plant^{-1}$ were IC 617961 (20.38 g) followed by IC 617957 (19.64 g), IC 613559 (19.13 g), IC 617956 (18.25 g) and 28 bijapur collection (17.88 g). The genotype IC 613556 (19.33%) and IC 613552 (12.26%) recorded significantly higher levels of protein content. Genotypes IC 617952 (33 mg $100g^{-1}$) and IC 617960 (29 mg $100g^{-1}$) recorded significantly higher levels of calcium content. Genotypes IC 617957 (15.32 mg $100g^{-1}$), IC 613552 (13.27 mg $100g^{-1}$), IC 617952 (13.01 mg $100g^{-1}$), IC 613553 (12.77 mg $100g^{-1}$), IC 613561 (12.59 mg $100g^{-1}$), IC 617954 (12.28 mg $100g^{-1}$), 28 bijapur collection (12.28mg $100g^{-1}$), IC 617960 (12.03 mg $100g^{-1}$), IC 613559 (11.20 mg $100g^{-1}$), IC 613557 (10.98 mg $100g^{-1}$), IC 613549 (10.23 mg $100g^{-1}$), IC 617959 (10.12 mg $100g^{-1}$), IC 617961 (10.12 mg $100g^{-1}$) and IC 613558 (10.06 mg $100g^{-1}$) recorded significant levels of iron content. Genotypes IC 606693 (2.8 mg $100g^{-1}$), 28 bijapur collection (2.8 mg $100g^{-1}$), IC 613554 (2.79 mg $100g^{-1}$), IC 617961 (2.79 mg $100g^{-1}$), IC 613556 (2.72 mg $100g^{-1}$), IC 617962 (2.72 mg $100g^{-1}$), IC 613548 (2.70 mg $100g^{-1}$), IC 613553 (2.69 mg $100g^{-1}$), IC 617957 (2.56 mg $100g^{-1}$), IC 613546 (2.54 mg $100g^{-1}$) and IC 617956 (2.43 mg $100g^{-1}$) recorded significant levels of zinc content. Genotypes IC 613554 (9.87%), IC 613558 (9.71%), IC 613555 (9.36%), IC 613562 (8.8%), IC 617956 (8.78%), IC 613556 (8.76%), IC 613557 (8.69%), IC 613561 (8.68%), IC 613550 (8.61%) and IC 617961 (8.57%) recorded significantly high levels of crude fiber content.

The genotypes that had significantly higher grain yield $plant^{-1}$ {IC 617961 (20.38 g) followed by IC 617957 (19.64 g), IC 613559 (19.13 g), IC 617956 (18.25 g) and 28 bijapur collection (17.88 g)} (bolded in Table 1 and presented in Fig. 1.) were estimated for nutritional traits. Among these genotypes, IC 617961 recorded significantly higher levels over mean for zinc content (2.79 mg $100g^{-1}$), iron content (10.12 mg $100g^{-1}$) and crude fibre content (8.57%) and on the other side this genotype recorded low calcium content (9 mg $100g^{-1}$) and protein content (9.63%). Genotype IC 617957 recorded significantly high levels of iron content (15.32 mg $100g^{-1}$) and zinc content (2.56 mg $100g^{-1}$) and low calcium content (11 mg $100g^{-1}$), protein (9.46%) and crude fibre content (7.73%). Genotype IC 613559 recorded significantly higher levels of iron content (11.20 mg $100g^{-1}$), meanwhile it recorded low calcium content (11 mg $100g^{-1}$), zinc content (1.95 mg $100g^{-1}$), crude fibre content (7.81%) and protein content (10.68%). Genotype IC 617956 recorded significantly higher levels of zinc content (2.43 mg $100g^{-1}$) and crude fibre content (8.78%) and lower levels of protein content (10.33%), iron content (7.59 mg $100g^{-1}$) and calcium content (17 mg $100g^{-1}$). Genotype 28 bijapur collection recorded significantly higher levels of zinc content (2.80 mg $100g^{-1}$) and iron content (12.28 mg $100g^{-1}$) and lower levels of calcium content (15 mg $100g^{-1}$), protein content (10.51%) and crude fibre content (7.11%).

These high yielding genotypes with good quality characteristics could possibly be used in breeding programmes and promotion of large scale cultivation and consumption. Underutilized species like browntop millet is likely to be useful in fighting malnutrition and hidden hunger, both in areas of cultivation and outside.

Table 1: Details on nutritional parameters and grain yield of 30 browntop millet genotypes under study

S. No.	Genotype	Protein (%)	Calcium (mg $100g^{-1}$)	Iron (mg $100g^{-1}$)	Zinc (mg $100g^{-1}$)	Crude fibre content (%)	Grain yield $plant^{-1}$ (g)
1	IC 606693	10.33	11.00	6.25	2.80**	7.99	10.38
2	IC 613546	10.50	9.00	6.81	2.54**	7.68	6.77
3	IC 613547	9.81	17.00	3.70	1.67	7.75	7.23
4	IC 613548	9.11	13.00	4.88	2.70**	7.62	8.50
5	IC 613549	10.85	11.00	10.23*	1.91	6.72	7.77
6	IC 613550	9.28	13.00	6.05	1.90	8.61*	12.40
7	IC 613551	11.91	9.00	7.34	1.70	7.19	13.95
8	IC 613552	12.26*	13.00	13.27**	2.18	8.37	10.25
9	IC 613553	9.98	18.00	12.77**	2.69**	8.47	9.00
10	IC 613554	11.38	15.00	5.05	2.79**	9.87**	14.25
11	IC 613555	11.73	9.00	8.95	1.36	9.36**	9.27
12	IC 613556	19.33**	11.00	3.75	2.72**	8.76**	14.32
13	IC 613557	9.81	13.00	10.98**	1.74	8.69*	4.74
14	IC 613558	10.16	17.00	10.60*	1.99	9.71**	13.91
15	IC 613559	10.68	11.00	11.20**	1.95	7.81	19.13**
16	IC 613560	8.93	15.00	5.10	1.43	8.34	11.19
17	IC 613561	11.12	11.00	12.59**	2.22	8.68	11.19

18	IC 613562	10.16	17.00	6.55	1.74	8.80	11.09
19	IC 617952	10.86	33.00**	13.01**	1.99	7.75	13.88
20	IC 617953	9.98	9.00	9.29	1.38	7.52	12.50
21	IC 617954	11.03	8.00	12.28**	1.53	7.57	13.75
22	IC 617955	11.64	8.00	6.44	1.99	6.50	11.24
23	IC 617956	10.33	17.00	7.59	2.43*	8.78**	18.25**
24	IC 617957	9.46	11.00	15.32**	2.56**	7.73	19.64**
25	IC 617958	10.51	19.00	3.91	1.41	7.12	9.54
26	IC 617959	10.33	17.00	10.12*	2.26	7.31	9.50
27	IC 617960	9.81	29.00**	12.03**	1.42	7.76	14.63
28	IC 617961	9.63	9.00	10.12*	2.79**	8.57*	20.38**
29	IC 617962	10.16	11.00	7.28	2.72**	7.63	7.50
30	28 bijapur collection	10.51	15.00	12.28	2.80**	7.11	17.88**
Mean		10.72	13.97	8.86	2.11	8.06	12.13
C.D. 5%		1.32	3.24	1.18	0.29	0.50	4.24
C.D. 1%		1.78	4.36	1.60	0.40	0.68	5.71

Significantly high yielding genotypes were bolded
* Significance at 5% level
** Significance at 1% level

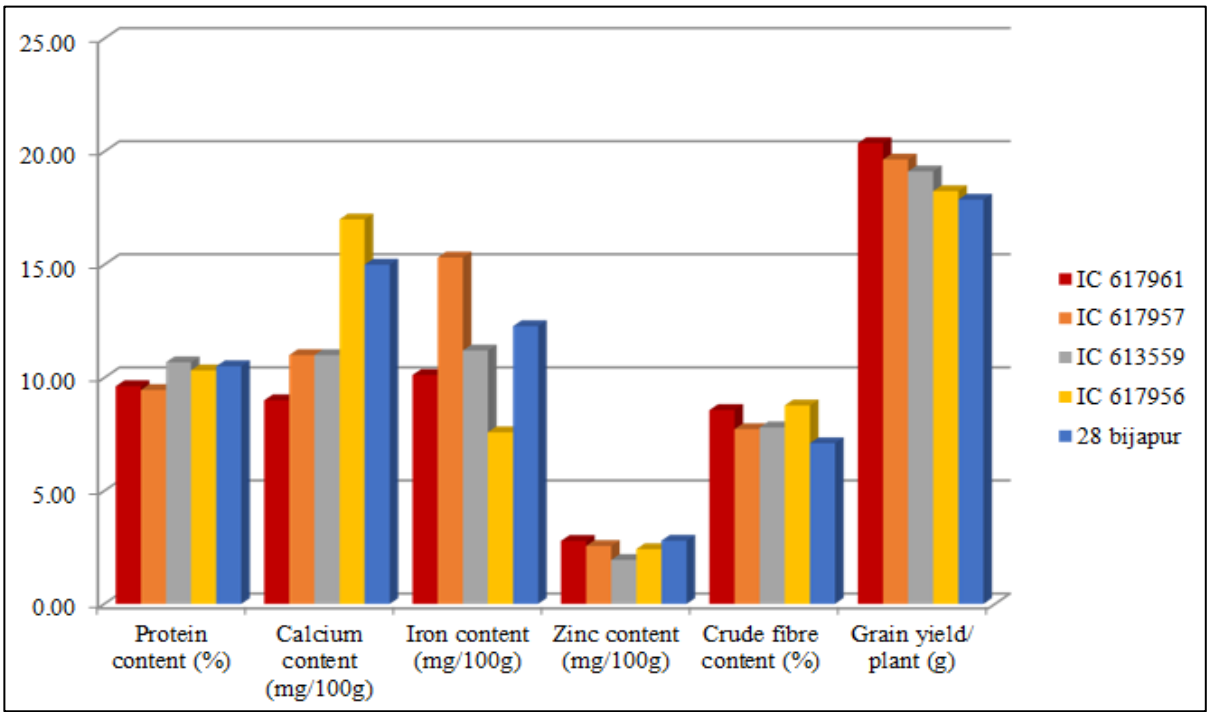

Fig 1: Performance of high yielding genotypes for quality traits

Conclusion

Based on the above observations, the genotype IC 617961 recorded high grain yield plant^{-1} with significant levels of iron, zinc and crude fiber contents. This genotype can be used in the hybridization programmes to obtain desirable segregants for higher grain yield. However, IC 613556 recorded highest protein content, IC 617952 recorded highest calcium content, IC 617957 recorded highest iron content, IC 606693 and 28 bijapur collection recorded highest zinc content and IC 613554 recorded highest crude fibre content. These genotypes can be used individually for improvement of quality traits in browntop millet.

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