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RESEARCH ARTICLE

GERMPLASM COLLECTION OF FINGER MILLET (*Elucine coracana* (L.) Gaertn) LAND RACES GROWN BY TRIBALS OF THANE DISTRICT MAHARASHTRA

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ABSTRACT

Finger millet is the second largest cereal crop grown (after rice) in tribal area of Thane district. Warli, Malharkoli, Thakar and Dorkoli are the major tribes inhabiting the Thane district of Maharashtra. Their traditional methods of agriculture and landraces of different crops they conserved are fast eroding due to the rapid urbanization of the district. .Tribals of Thane district has conserved 11 landraces of finger millet on farm by their traditional agricultural system. These land races are studied for their cultural, Morphogenetic and nutritional aspects. The analysis of 11 landraces collected from this region revealed that there are three reddish black grains, two copper red grains, five light brown colored grains and only one land race with white grains. Results of this study include identification of varieties for drought tolerance, disease resistance, high yield, high protein content, high amino acid content and low carbohydrate content. The importance of conservation of such rich finger millet diversity from this fast changing agro-ecosystem of Thane district is discussed.

INTRODUCTION

Finger millet (*Elucine coracana* (L.) Gaertn) is an important cereal crop cultivated mostly in semiarid region of Africa and India (Hilu and De Wet, 1976a). Finger millet is also known as birds foot millet. In India it is known by different vernacular names such as Nagli or Nachani in Marathi, Ragi in Telguand Kannada, Manduwa or Kodra in U.P. and Kodo in Nepal. The Elusine include 11 species that are distributed widely in tropics and sub tropics (Gond 1989). The most commonly found species are *E. coracana* and *E. indica* of which former is cultivated species. It is the native of Africa and was domesticated first in East African high lands with subsequent movement to South Africa. From there it has migrated to India via human trade around 1000B.C (de *Wet et al.,* 1984). In India, which is responsible for approximately half of the worlds production of finger millet grains it is grown annually on about 2.0 million hectors with a production of 2.6 million tons of grains. (Anon, 1998) .The crop is valued for its versatility as a staple food, its excellent storage quality, resistance to diseases and tolerance to soil moisture stress. (Hilu and De Wet, 1976a; Bhandari, 1974; Rao and Krishnamourthy, 1981).These features have made finger millet an important cereal in low fall area, affordable for poor and an important food source during famine (Bhandari, 1974). One can estimate easily the magnitude of variability available in this plant from the report of AICSMIP, Which documented the evaluation of data of 3940 accession for 37 characters (Ramkrishna *et al.,* 1996). Its cultivation extends up to an elevation of 2,700 m in the hills of Kumaon and Gharwal regions (Joshi *et al.,* 1983). The author evaluated 630 accessions collected from these regions. They found high degree of variations in quantitative characters like days to 50% flowering (51-91 days), plant height (50-140 cm), finger per ear (4-12) and finger length (3-18 cm). Similarly an evaluation data for 560 accession from Maharashtra state reveals a range for height from 45-120 cm, number of fingers per plant from 4-16, finger length 44.0 to 10.7 cm and days to maturity from 109 to 159. When compared to these, the accession of Sikkim and Malawi has shown higher values for the same quantitative character. However yield per plant of Maharashtra accession was higher (Harinarayan et al; 1983) They concluded that plant height , finger number and number of basal tillers are important character for selection in case of Maharashtra collection. Improvement of nagli in Konkan region of Maharashtra was carried out by introduction and selection methods (Dhonukshe *et al.,* 1983). They found that Maharashtra collection performed better than introduced types. In the present paper 11 finger millet landraces are reported for the first time from tribal dominated region of Thane district in Maharashtra state and are investigated for their morphogenetic, cultural, yield and nutritional variation .It is valuable addition to the germplasm collection of finger millet of Maharashtra.

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MATERIAL AND METHODS

Area of exploration

Thane is the largest and tribal district of Maharashtra state. Area selected for exploration of finger millet landraces is the north part of the district including four talukas namely: Talasari, Vikramgad, Jawar and Mokhada. Shayadri mountain ranges run through these talukas .This area is totally rainfed ecosystem and purely tribal area. Tribes inhabiting these talukas are warli, Thakar, Mahadev koli and Katkari. Major crops in this region are Rice and Nagli.

Survey and collection

Ethno botanical principles were followed for the collection of different landraces of finger millet crops grown by tribal people of the district. Accession numbers were given to all samples and their passport information was recorded separately. Morphogenetic differences among the landraces and their yield characteristics are recorded.

Analysis of grains

Total carbohydrates were extracted by the method of Hegde and Hofreiter(1992) and estimated employing the method of McCredy *et.al.* (1950).The grain proteins were precipitated in TCA ,dissolved in 0.05 N NaOH and measured as per Lowry *et.al.(*1951).For estimation of free amino acids the grain powder extracted in 80% served as sample . The method of Harding & Maclean (1916) was employed for estimation of amino acids. Average of three replicates was recorded for every sample and the amount s were expressed in g/ 100g dry weight i.e. percentage.

RESULTS AND DISCUSSIONS

In all 11 landraces of finger millet collected from four Tahsils of Thane district. Local names of the cultivars are meaningful revealing certain feature. The Pittarathi indicates its harvesting period i.e. before 'Pitru Paksha'. Khandri indicating gaps on the fingers. Malgond is so called because it belongs to hill and having curved fingers. Kamala is named for its lotus like ear head. Lakhi indicates Dark reddish black grains .Kalperi possesses black spots on nodes. Shitodi means white colour grains. Bendri refers to grayish brown colour grains. Davtari refers to white stem. Table 1 showing range of the morphogenetic characteristics of these cultivars such as height of the plant ranging from 70 to 120 cm, number of panicles per head 6 to 14 and the length of panicle ranging from 6 to 12 cm.There are three landraces with reddish black grains . These are accession no F02, F09 and F10 i.e. Bendri halvi, Lakhi and Lal halvi . Accession no. F04 and F05 i.e. Malgond and Kalperi these two with copper red grains. Other five having light brown colored grains (Accession no.F01 F03 F07 F08 F11) and only one land race i.e. accession no. F06 Shitodi is with white grains. Days to maturity ranging from 70 to 160 days .Early maturing varieties are Pittarathi70 days, Lakhi 90 days and Lal halvi 110 days. Table 2 showing range of yield characteristics. Range of 100 grain weight is from 0.18 to 0.31gm and the grain yield ranging from 13 gm to 23 gm per plant. Accession F01 Dhavtari showing highest yield and the Lakhi (F09) showing lowest yield. Fig 2 Showing group of land races on the basis of their yield per plant. It showing that 3 cultivars i.e. F3 F5 F09 having yield between 12.01 and 15.00 gm, other three cultivars – F4,F2, F10 having yield between 15.01 to 18.00 gm , two cultivars i.e. F6 and F7 having yield between 18.01 to 20.00 gm and three cultivars F1, F8 and F11 Showing higher yield between 20.01 to24.00.

Table 1. Morpho-genetic characteristics of different landraces Finger millet collected from tribal area of Thane district

Accession No.	Landrace (Local name)	Plant Height (cm)	No. Panicles	Panicle length (cm)	Grain color
F01	Dhavtari	70-90	8-10	11	Brown
F02	Bendri Halvi	87-100	6-8	8-9	Reddish black
F03	Kamala	90-95	4-5	10-11	Brown
F04	Malgond	100-105	7-9	6-7	Copper red
F05	Kalperi	86-90	6-7	7-8	Copper red
F06	Shitodi	90-95	10-12	7-8	White
F07	Khandari	85-90	7-8	10-11	Brown
F08	Bendri	70-90	8-10	6-7	Brown
F09	Lakhi	72-75	6-7	7-8	Reddish black
F10	Lal Halvi	74-80	8-10	6-7	Redish black
F11	Pittarathi	85-95	10-12	8-9	Brown

Table 2. Yield characteristics of different landraces of Finger millet collected from tribal area of Thane district Maharashtra

Accession No.	Landrace (Local name)	Diameter of grain (cm.)	100 –grain weight (gm)	Grain yield per plant. (gm)	Character
F01	Dhavtari	0.22	0.20	23.22	Gives strength in weakness
F02	Bendri Halvi	0.18	0.20	16.05	Early maturity
F03	Kamala	0.19	0.28	15.00	Ear head look like lotus.
F04	Malgond	0.20	0.26	15.02	Inward curved head.
F05	Kalperi	0.20	0.26	14.95	Stem white with black nodes
F06	Shitodi	0.20	0.27	20.00	Easy to digest.
F07	Khandari	0.20	0.30	19.12	Gaps on fingers
F08	Bendri	0.20	0.31	22.50	Grayish ear head
F09	Lakhi	0.19	0.27	13.02	Hard to digest.
F10	Lal Halvi	0.15	0.18	17.45	Popular
F11	Pittarathi	0.23	0.27	20.50	Early maturity

Table 3. Nutritional values of Finger millet Landraces collected from tribal area of Thane district Maharashtra

Accession No.	Insoluble Proteins g/ 100 g	Total Amino Acids g/100g	Free Amino Acids g / 100 g	Total Hydrolysable Carbohydrates g / 100 g
F01	4.20	1.42	0.46	48
F02	2.12	1.00	0.20	42
F03	2.22	1.08	0.22	34
F04	3.40	1.36	0.52	42
F05	3.44	1.40	0.44	42
F06	1.60	1.04	0.24	50
F07	3.60	1.32	0.22	38
F08	3.60	1.30	0.32	45
F09	2.44	1.20	0.20	48
F10	2.22	1.10	0.22	32
F11	3.24	1.28	0.28	38

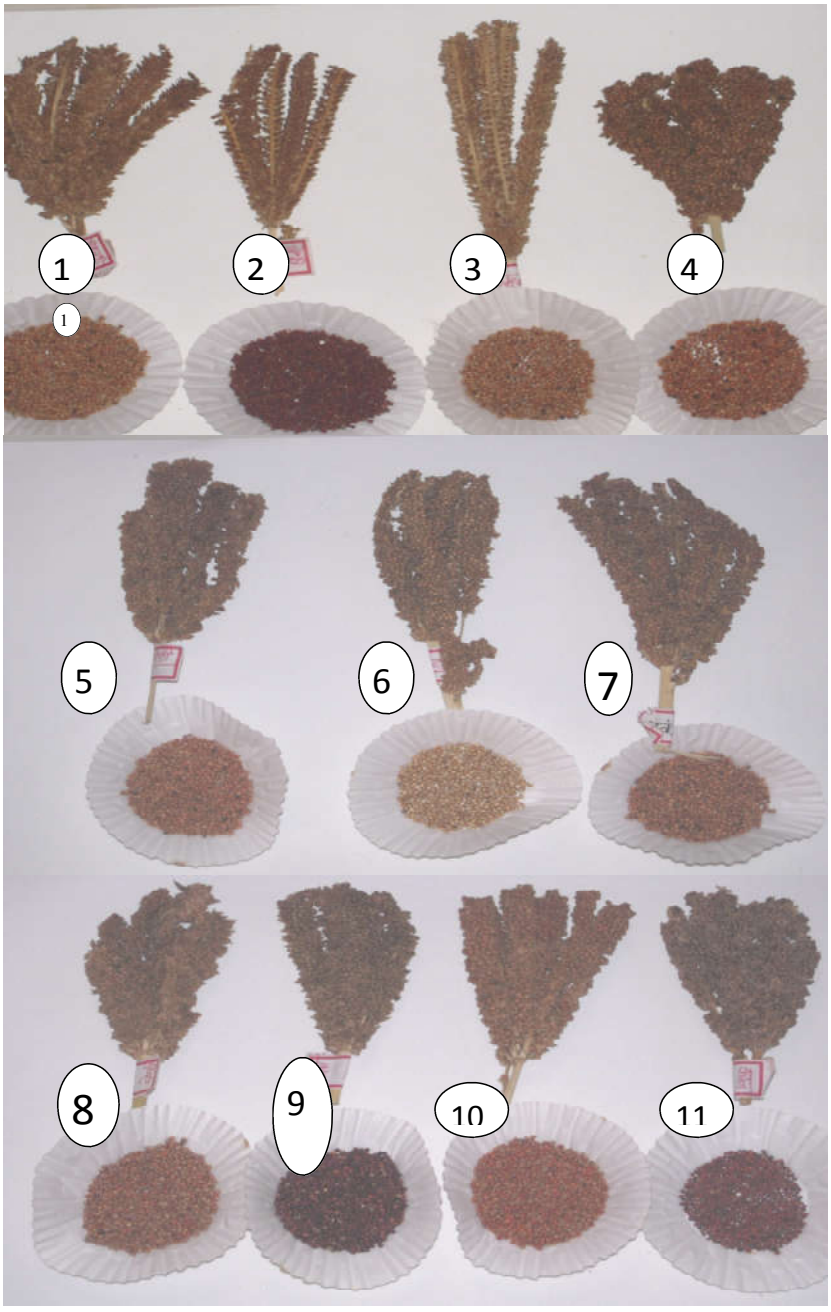

Plate 1. Photographs of land races of finger millet- Ear head and grains

1. Dhavtari 2. Bendri Halvi 3. Kamala 4. Malgond 5. Kalperi 6. Shitodi 7. Khandari 8. Bendri 9. Lakhi 10. Lal Halvi 11. Pittarathi

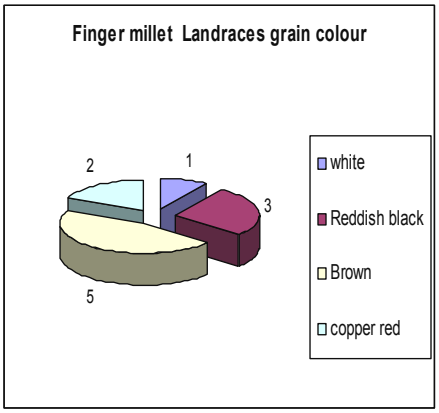

Fig. 1. Grain colour finger millet cultivars

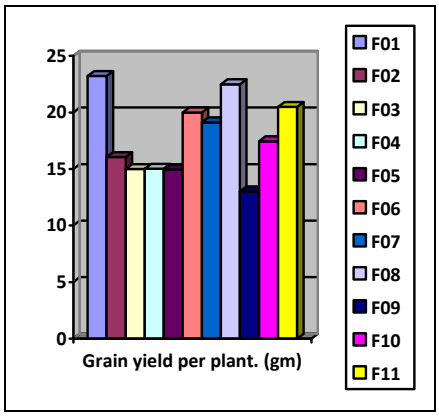

Fig. 2. Grain yield of finger millet cultivars

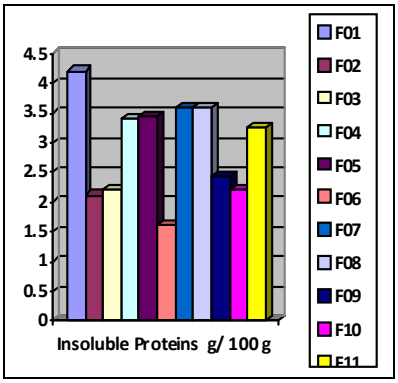

Fig. 3. Bar graph showing insoluble protein content

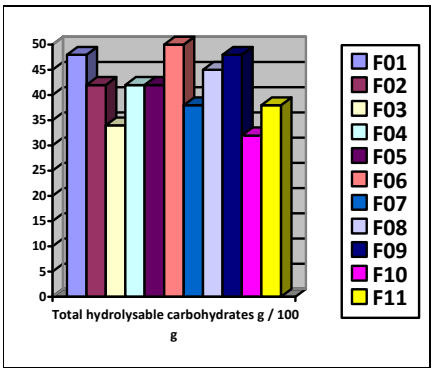

Fig. 4. Bar graph showing total hydrolysable carbohydrates content

Table 3 showing nutritional values of collected varieties. Protein content of the cultivars ranging from 1.60% to 4.29 %, carbohydrate content ranging from 34% to 50 %, total amino acids level ranging from 1.00 to 1.42 % and free amino acids level ranging from 0.22 to 0.46 %.Our results are in general agreement with previous investigators who have reported that finger millet is generally higher in protein and amino acid. Fig 3 showing insoluble protein content of these cultivars. One cultivar i.e. accession no. F06 showing the protein content from 1.00 to 2.00 %(1.60%), four cultivars i.e. accession no. F2, F3, F09, F10 showing protein content between 2.01 to 3.00% , Five landraces i.e. accession no. F4, F5, F7, F8 and F11 showing protein content between 3.01 to 4.00% and only one cultivar F01 showing the highest protein content i.e. 4.20%. However, the protein content of these landraces is less than the WHO standard of 9-12 % . In the present report the grains are screened for only insoluble protein levels , if the fraction soluble fraction is also considered than total proteins may be still higher to touch the WHO standard. Fig 4 showing the carbohydrate of the 11 cultivars. Accession no. F3, F7, F10 and F11 showing carbohydarate content from 30 to 40 %, accession no. F1, F2, F4, F5, F8, and F9 showing carbohydrate content ranging from 41% to 50% . Accession no. F 6 showing the highest carbohydrate content i.e. 50%.

Finger millet cultivation is comparatively more in Jawhar and Mokhada Taluka of Thane district. Tribals of this area have conserved the valuable germplasm of Nagli. Early maturing varieties like pittarathi. Bendri halvi and Lakhi takes very short period to get mature for harvesting. Pittarathi get ready within 70 to 80 days. These varieties provide the grain earlier when their previous stock of grain is about to exhaust. These varieties are harvested by cutting their ear head and dried on the Utane (A Bamboo tray hanged over the fire of oven). Tribals have recognized Nagli as nutritive food and provide sustainable diet for hard working people. So they prefer to eat Nagli Bhakar (Roti) in afternoon meal and eat rice meal in the night. Several cases of malnutrition of children in this area have been reported in recent past. One of the possible region for this may be that the Nagli bhaker is not given to young children as it is tough and difficult to chew, otherwise finger millet is generally higher in protein ,amino acid and calcium than other cereal grains (Pore M S, Magar N G 1979, W.E. Barbeau, K.W. Hilu1993). In southern parts of India, pediatricians recommend finger-millet-based food for infants of six months and above because of its high nutritional content, especially Iron and calcium. Home made Nagli malt happens to be one of the most popular infant food even to this day. The grain is made into a fermented drink (or beer) in Nepal and in many parts of Africa. In Goa Nagli is very popular and satva, pole (dosa), bhakri, ambil (a sour porridge) are very common preparations. In Thane district it is used as Bhakri , Papad and Ambil . There are no reports of making alcoholic drinks from Nagli in Maharashtra. Finger millet has the potential to improve nutrition, boost food security, foster rural development and support sustainable land care. Finger millet grown in this region are highly valuable as they possess important morphogenetic and agronomic characters. Low carbohydrate and high protein content and their drought tolerance, short crop duration make these land races an important germplasm collection for further crop improvement program. It is an urgent need to take necessary steps to conserve these cultivars of finger millet.

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