Indian J. Agric. Res., 53(5) 2019: 624-627
Print ISSN:0367-8245 / Online ISSN:0976-058X

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
www.arccjournals.com

Evaluation of finger millet [*Eleusine coracana* (L.) Gaertn.] accessions using agro-morphological characters

Sanjay Patil, Vitthal Kauthale*, Santosh Aagale, Mavanji Pawar and Anjali Nalawade

BAIF Development Research Foundation,
BAIF Bhavan, Dr. Manibhai Desai Nagar, Warje, Pune-411 058, Maharashtra, India.
Received: 02-03-2019 Accepted: 31-05-2019 DOI: 10.18805/IJARe.A-5239

ABSTRACT

The study was conducted at village level *in-situ* center, Jawhar block of Palghar district of Maharashtra during the year 2017 and 2018 to characterize 20 accessions of finger millet. Data was collected on morphology, plant growth and yield contributing characters. Traits like erect growth habit (80 percent); semi-compact ear (60 percent); partially enclosed seeds by glumes (60 percent) and light brown colour of seed (75 percent) was found dominant among studied accessions. The results indicated that studied landraces exhibited variability in finger number (6 to 14), finger length (7 to 16 cm) and maturity days (85 to 117). The results of study also showed that productive tiller number was most varied trait (29.37 percent), followed by ear head length (21.98 percent) and finger number (19.42 percent). Among the studied traits, finger width showed the lowest variation (7.65 percent). Analysis of variance showed that all the characters were highly significant among the accessions. This potential gene pool needs to be conserved and may be explored for crop improvement in future.

Key words: Assessment, DUS, Finger millet, Germplasm, Variability.

INTRODUCTION

Finger millet [*Eleusine coracana* (L.) Gaertn.; Family- Poaceae] is a self-pollinated crop with diverse uses as staple food and fodder. Finger millet is known by various names like *Ragi, Nachani, Nagali and Mandua* in various languages (Dayakar *et al.,* 2017). It is nutritionally superior to many other cereal grains as it is rich in calcium, iron, dietary fibre and polyphenols with slow digestibility (Chethan and Malleshi, 2007; Yenagi *et al.,* 2010). Tribal communities cultivating this crop and have their own germplasm since ages. This germplasm is exposed to changing climatic conditions and accumulated considerable diversity for vegetative, reproductive and physiological characters over the years of domestication. (Karad *et al.,* 2013). In India, finger millet is third important crop among the millets after sorghum and pearl millet (Saritha *et al.,* 2016) and grown on an area of 2 million hectares with a production of 2.15 million tones, which accounts for 45 per cent of the world's cultivated area and 55 per cent of the world's production (www.indiaagristat.com). The germplasm identification and characterization is an important link between the conservation and utilization of plant genetic resources (Umar and Kwon-Ndung, 2014). Therefore, the present study was undertaken to study the extent of variability as well as to characterize the finger millet accessions and local types for agro-morphological characters.

MATERIALS AND METHODS

Twenty accessions of finger millets were collected from different farmers in Thane and Nasik district during 2008-2015 (Table 1). Ten collections from Nasik district were kindly donated by Department of Botany, H.P.T. Arts and R.Y.K. Science College, Nasik. Experiments for characterization were carried out during June to September 2017 and 2018. The seeds of collected accessions along with two release varieties were sown in village level *in-situ* conservation center at Jawhar block established under Maharashtra Gene Bank Program. The experiments were conducted in randomized block design (RBD) with plot size 3 m x 2.25 m replicated three times. Thirty days old seedlings transplanted by using ridges and furrows method spaced at 25 cm x 25 cm. Recommended package of practices were followed during crop growth period. The visual observations were recorded on 13 qualitative traits *viz.* growth habit, presence of pigmentation at leaf juncture, leaf sheath pubescence, culm branching, ear shape, finger branching, position of finger branching, arrangement of fingers in multiple whorl, seed shattering, seed covering by glumes, seed color, seed shape and seed surface. 11 quantitative traits *viz.* flag leaf blade length, flag leaf blade width, peduncle length, ear head length, finger length, finger width, fingers per ear, productive tillers per plant, plant height, days to maturity and yield were recorded according to morphological descriptor DUS guideline provided by Protection of Plant Variety and Farmers Right Authority (http://plantauthority.gov.in/crop-guidelines.htm). Analyses of variance were performed on each morphological data to test the significance of variation between accessions by using

*Corresponding author's e-mail: vitthal.kauthale@baif.org.in

DBSTAT software. Principle component analysis (PCA) was performed by using PAST software to investigate and summarize the underlying trends of variation.

RESULTS AND DISCUSSION

Qualitative characters: Majority of accessions were with erect growth habit (80 percent). Anthocyanin pigmentation at leaf juncture was present in two accessions (10 percent). The hairiness on leaf sheath was observed in 55 percent accessions, Culm branching was observed in 6 (30 percent) accessions. The shape of ear varied as open, semi compact, compact and fist type. Majority of accessions (60 percent) showed semi-compact type of ear; open (25 percent) type followed by fist type (10 percent) and compact (5 percent). Finger branching was observed in 8 accessions, out of which 4 accessions had branching in all fingers while 4 accessions had branching only in thumb finger. Multiple whorls in ears were observed only in 5 accessions while majority accessions (75 percent) were without multiple whorls. 90 percent accessions were non shattering type. Most of accessions (60 percent) were with partially covered seeds by glumes. Seed colour varied as white, light brown, copper brown and dark brown and light brown was most dominant (75 percent) colour among studied accessions Malambane and Jaisil (2015) recorded ragi brown seed colour as most dominant in Thailand germplasm among six seed colors *viz.* white, light brown, brown, ragi brown, red and purple. Studied accessions showed variation in seed shape as reniform (50 percent), round (40 percent) and ovoid (10 percent) while trait seed surface was observed as smooth (50 percent) and rough (50 percent).

Principal components analysis (PCA) was performed for all multivariate data derived from qualitative characters with respect to each accession. The studied 20 accessions were divided into four groups based on PCA as shown in Fig 1.

The analysis revealed that accessions F-9, F-6, F-4, F-7, F-2 and T-10 were close to each other and vector 'growth habit' was contributing in clustering them (Group I). The vectors 'seed surface', 'seed colour', 'seed shape', 'seed shattering' and 'seed glume cover' contributed in grouping of F-10, F-13 and T-19 together (Group III). The accessions T-5, F-1, F-5, T-28 and T-2 group together and mainly influenced by vector 'finger branching' (Group IV). The remaining F-12, T-8, T-3, T-1, T-14 and T-15 accessions grouped together separately (Group II) and shown no association with specific vectors.

Quantitative characters: The mean values of quantitative characters of finger millet accessions are given in Table 2. The results of present study showed that productive tiller number was most varied trait (29.37 percent), followed by ear head length (21.98 percent) and finger number (19.42 percent). Among the studied traits, finger width showed the lowest variation (7.65 percent). Analysis of variance showed that all the characters were highly significant among the accessions. The studied accessions showed length of flag leaf blade ranged between 26.60cm (F-7) to 42.57 cm (T-28) and width 1.13cm (T-3) to 1.57 (T-10). Productive tillers per plant varied from 3.33 to 7.67 and the number of fingers was recorded from 6.33 (F4) to 14 (T-14). Goswami *et al.*, (2015) in their study has reported highest finger number of 9.96. Accession T-28 had shortest peduncle (18.13 cm) while F-4 had longest (30.47 cm) peduncle. Ear head length and width ranged from 6.69 cm (F4) to 15.60 cm (T15) and 1.07 cm (T19) to 1.43 cm (T15) respectively. This is at par from Chandrashekhar *et al.*, (2011) and Goswami *et al.*, (2015) observations who recorded 9.2 cm longest finger length among 1000 genotypes.

Shortest plant was observed in accessions F-2 (93.27cm) while longest height was observed in F-4 (126.30 cm). Accessions F-1 required minimum span (82 to 102 days) for maturity while accessions T-2, T-10, T- 28, F13 and T-14 required maximum time (117 to 137days) for maturity. 1000 grain weight ranged from 1.8 g (T-5) to 3.2 g (F-4). Highest grain yield (2547 kg/ha) was recorded in T-10 accession with a straw yield (3903 kg/ha). The maximum number of fingers per ear has contributed in higher grain yield. The results are in line with Lule *et al.*, (2012) who reported higher and positive direct effect of finger number on grain yield. Accession T-28 yields highest straw (7723 kg/ha) while accession T-19 showed lowest grain yield (878 kg/ha) and straw yield (1587 kg/ha) while release variety produces 2353 kg/ha grains and 6285 kg/ha straw i.e. T-10 and T-28 accessions has higher grain and straw yield than release

Table 1: Details of finger millet accessions collection.

Accession Code	Denomination	Collection localities
F-2	*Dasar Bendri*	Thane, Maharashtra
T-19	Local	Nasik, Maharashtra
F-12	*Nagali* Late	Thane, Maharashtra
F-4	*Malgond*	Thane, Maharashtra
F-1	*Pitar Bendri*	Thane, Maharashtra
T-15	Local	Nasik, Maharashtra
F-6	*Nagali* Red	Thane, Maharashtra
T-5	Local	Nasik, Maharashtra
T-2	Local	Nasik, Maharashtra
F-9	*Dhavalperi*	Thane, Maharashtra
T-8	Local	Nasik, Maharashtra
F-13	*Shitoli* (type-1)	Thane, Maharashtra
F-5	Kalperi	Thane, Maharashtra
T-10	Local	Nasik, Maharashtra
T-3	Local	Nasik, Maharashtra
F-10	*Shitoli* (type-2)	Thane, Maharashtra
F-7	*Shitpadi*	Thane, Maharashtra
T-1	Local	Nasik, Maharashtra
T-14	Local	Nasik, Maharashtra
T-28	Local	Nasik, Maharashtra

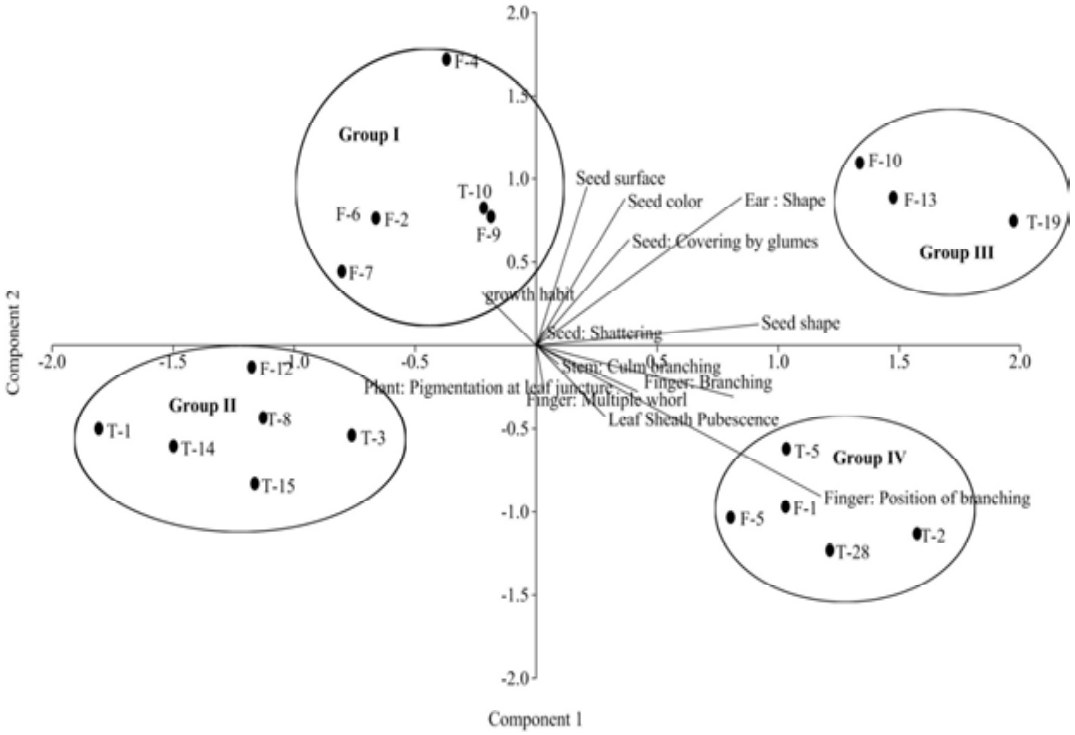

Fig 1: Principle component analysis of finger millet accessions.

Table 2: Quantitative characters of finger millet accessions.

Accession code	Flag leaf blade length (cm)	Flag leaf blade width (cm)	Peduncle length (cm)	Ear head length (cm)	Finger length (cm)	Finger width (cm)	Finger number	Productive tiller number	Plant height (cm)	Days to Maturity
F-6	32.50	1.40	26.27	9.73	9.73	1.37	9.67	3.67	115.63	116
T-3	34.57	1.13	25.27	11.90	9.53	1.33	10.00	5.67	115.60	112
F-4	34.87	1.23	30.47	7.83	6.93	1.30	6.33	6.67	126.30	111
T-2	35.97	1.23	24.17	12.47	11.03	1.30	12.00	4.67	104.37	117
T-19	33.40	1.17	21.83	8.17	6.70	1.07	8.33	5.67	102.03	95
F-1	30.20	1.47	23.93	13.50	9.50	1.37	10.00	3.67	117.60	82
F-9	31.77	1.13	20.00	12.47	9.77	1.27	11.33	4.33	101.87	109
F-5	37.53	1.37	22.23	13.70	9.03	1.27	9.56	3.33	102.57	105
F-12	35.67	1.27	21.90	11.93	9.07	1.33	10.00	4.33	113.67	99
T-14	38.70	1.33	23.00	15.30	12.23	1.27	9.00	4.00	121.97	117
F-13	32.40	1.27	19.63	13.67	10.10	1.27	10.33	4.33	95.27	117
F-2	28.90	1.27	23.27	12.63	10.27	1.33	10.33	3.33	93.27	85
T-1	34.20	1.20	25.37	13.63	11.13	1.33	9.67	3.33	106.23	105
F-10	32.70	1.43	21.17	10.37	8.97	1.43	9.33	5.33	120.10	112
T-5	38.63	1.13	22.97	17.53	13.47	1.33	14.00	4.00	110.17	113
F-7	26.60	1.20	22.67	11.57	9.17	1.23	10.67	6.00	112.63	100
T-8	35.63	1.47	22.33	13.00	10.73	1.33	8.67	4.33	105.23	110
T-10	41.23	1.57	23.77	11.70	8.73	1.37	13.33	3.67	116.00	117
T-28	42.57	1.33	18.33	14.73	10.30	1.40	9.33	4.33	120.00	117
T-15	35.77	1.30	21.67	18.13	15.60	1.43	12.00	4.33	111.30	116
Mean	**34.69**	**1.30**	**23.01**	**12.70**	**10.10**	**1.32**	**10.20**	**4.45**	**110.6**	**107.75**
SE m (±)	0.56	0.585	0.018	0.434	0.36	0.271	0.013	0.256	0.169	0.032
Range	26.6-42.57	1.13-1.57	18.33-30.47	7.83-18.13	6.70-15.60	1.07-1.43	6.33-14.00	3.33-6.67	93.27-126.30	82-117
CV %	13.06	10.92	14.61	21.98	20.79	7.65	19.42	29.37	8.75	9.85
p<0.01	**	**	**	**	**	**	**	**	**	**

variety. The grain straw ratio ranged from 0.22 (T-28) to 0.65 and highest was recorded in accession T-10. As finger millet is one of the major crops in study area, the straw yield is important desirable character along with grain yield in farmer's perspective and therefore accessions with low grain straw ratio are still under cultivation.

CONCLUSION

The study revealed significant differences among the finger millet accessions and variability existed in the collected germplasm. The ear shape, seed colour, finger branching, maturity period, number of fingers, productive tillers, ear length, grain and straw yield are important influencing characters responsible for diversity. The conservation and further improvement of these germplasm is a need of an hour and the targeted finger millet improvement programme may be undertaken in future.

ACKNOWLEDGEMENT

The authors are thankful to Rajiv Gandhi Science & Technology Commission, Government of Maharashtra for financial support; Maharashtra Gene Bank Project team for their help in germplasm collection and experiment conduction; Member of research coordination committee, BAIF for their valuable suggestions and Mr. N. L. Phadke and Dr. R. A. Bahulikar for statistical analysis of data.

REFERENCES

Chandrashekhar, H., Mallikarjuna, N. M., Nagabhushan, G. D., Prahalada and Jayashree, U. (2011). Morpho-agronomic characterization of finger millet (*Eleusine coracana* (L.) Gaertn.) germplasm accessions. *Current Biotica*. **5**(2): 130-136.

Chetan, S. and Malleshi, N. G., (2007). Finger millet polyphenols: Characterization and their nutraceutical potential. *Am. J. Food Technol*. **2**(7): 582-592.

Dayakar Rao B., Bhaskarachary K., Arlene Christina G.D., Sudhadevi G., Tonapi, V. A. (2017). Nutritional and health benefits of Millets. ICAR Indian Institute of Millets Research (IIMR) Rajendranagar, Hyderabad, PP 112.

Goswami, A. P., Prasad, B. and Joshi, V. C. (2015). Characterization of finger millet [*Eleusine coracana* (L.) Gaertn.] germplasm for morphological parameters under field conditions. *Journal of Applied and Natural Science*. **7**(2): 836-838.

http://plantauthority.gov.in/crop-guidelines.htm

Karad S. R., Patil, J.V. and Kale A. A. (2013). Study of genetic diversity in finger millet (*Elesuine coracana* L.) genotypes using RAPD markers. *Int. J. Int sci. Inn. Tech*. **2**(4): 31-36.

Lule, D., Tesfaye, K., Fetene, M. and De Villiers, S., (2012) Inheritance & association of quantitative traits in finger millet (*E. coracana* Subsp. *coracana*) landraces collected from eastern & south eastern Africa. *Intl. J. Genet.* **2**(2): 12- 21.

Malambane, G. and Jaisil, P. (2015). Morphological variability for qualitative and quantitative traits in finger millet (*Eleusine coracana* L. Gaertn). *J. of Advances in Agri*. **5**(1): 528-537.

Saritha, H. S., Ravishankar, P. and Aruna, Y. R. (2016). Identification of high yielding, neck and finger blast resistant and nutrient rich white finger millet genotypes. *International Journal of Agricultural Science and Research*. **6**(3): 305-314.

www.indiaagristat.com

Yenagi, N.B., Handigol, J.A., Ravi, B., Bhag Mal, S. and Padulosi, S. (2010). Nutritional and technological advancements in the promotion of ethnic and novel foods using the genetic diversity of minor millets in India. *Indian J. Plant Genet. Resour*. **23**(1): 82-86.

Umar, I. D. and Kwon-Ndung, E.H. (2014). Assessment of variability of finger millet (*Eleusine coracana* (L) Gaertn) landraces germplasm in Northern Nigeria. *Nigerian Journal of Genetics*. **28**: 48-51.