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Characterization of Buffelgrass (*Cenchrus ciliaris* L.) Germplasm Using DUS Descriptors

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present study was carried on thirty seven Cenchrus genotypes during *rabi,* 2022-23. Tweleve traits were recorded as per the descriptors provided by PPV & FRA and several genotypes possessed unique traits that aids in genotype identification. The traits *viz.,*Growth habit ,Anothcyanin coloration on nodes, Node colour, Leaf blade altitude, Leaf blade pubescence, Awns distribution, Awns colour, Leaf colour, and Early vigour showed significant variation among genotypes. Quantitative Characters *viz*., Plant height, Leaf length (cm), Leaf width (cm), Inter-nodal

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length (cm), Nodes on tiller, Panicle length (cm), Tillers/Plant, Green fodder yield were recorded. The traits, Plant height, No. of tillers plant and green fodder yield recorded significant critical difference between the genotypes. Hence utmost care would be given for these characters while in the selection process of *Cenchrus ciliaris* crop improvement.

Keywords: Cenchrus; distinctiveness; uniformity; stability; quantitative parameters.

1. INTRODUCTION

Cenchrus ciliaris L. Buffelgrass (*C. ciliaris* L.) is a perennial (C_4) forage grass (family poaceae), sometimes produces rhizomes and is native to the Arabian Peninsula. The *C. ciliaris* is dominant in natural grazing zones of Ethiopia [1], Australia and North Africa [2]. Buffelgrass has proved useful for pasture and soil retention in a wide range of environments due to its drought tolerance, high biomass, deep roots, rapid response to summer rains, and resistance to overgrazing. With extensive belowground systems, cultivation of perennial grasses present high efficiencies in the use of nutrient and water resources and control of soil erosion, carbon sequestration with the restoration of soil properties (fertility, structure, organic matter). Compared with annual systems, herbaceous perennial crops have the advantages of erodibility, and crop management options, such as pesticides and fertilizers inputs [3]. The salt tolerance of different *C. ciliaris* genotypes need to be evaluated to test their suitability for marginal environments to offer a more practical solution for effective utilization of salt affected soils. The use of genetic resources by the researchers, gene bank managers and farmers will be limited by non-availability of essential information of their phenotypic and genotypic characters. Therefore, the accurate documentation of information about the origin, characterization and performance of germplasm is essential for effective conservation, use and also for the Intellectual Property Rights (IPR) issues.

The need of increasing the utilization of genetic resources to enhance the productivity of the crop has long been well recognized. The concept of DUS was fundamental to the characterization of variety as a unique creation [4]. The foremost objective of this study was phenotypic characterization of Cenchrus genotypes based on the DUS descriptors for various morphological characters.

2. MATERIALS AND METHODS

A total of thirty seven Cenchrus accessions FC TRY 1, FDC 168, VTCC-2, FDC 135, FDC 215, FDC 232, FDC 227, VTCC-5, FC-7, VTCS 1, VTCS-2, VTCS-5, FC-3, White cenchrus, FDC124, FDC 213, VTCC-6, FC-8, CO1, FC-5, FC-9, VTCS-3, VTCC-4, VTCC-8, FC-6, CO2, FDC 222, FC-1, FC-4, FC-10, VTCC-1, FC-2, FC-11, FC-14, Old VTCC1, VTCC-3, FC-13 collected from Dept. of Forages, TNAU, were evaluated on *rabi* 2022 at Anbil Dharmalingam College & Research Institute, Trichy, Tamil Nadu. Eighteen slips of each entry were planted and maintained. The accessions were grown in plot size of 3 m x 4 m in 3 replications with row to row spacing of 45 cm x 20 cm. Fertilizers were applied at the rate of 40:20:0 kg/ha NPK respectively. The different qualitative and growth attributes were recorded at different crop growth stages for the all accessions. The descriptors viz., Growth habit, Anothcyanin colouration on nodes, Node colour, Leaf blade altitude, Leaf blade pubescence, Awns distribution, Awns colour, Leaf colour, and Early vigour were recorded and documented. The quantitative attributes viz., Plant height (cm), Leaf length (cm), Leaf width(cm), Internode length(cm), No. of nodes, Panicle length (cm), No. of tillers and Green fodder yield/plant (g)were recorded.

3. RESULTS AND DISCUSSION

Relative and absolute frequency were observed for Thirty seven genotypes and grouped based on nine morphological traits (Table 1). In order to find distinctiveness among genotypes both qualitative and quantitative characters were observed for evaluation. Qualitative traits were considered as morphological markers in the identification of genotypes because they are less influenced by the environment. Morphological traits were important for varietal description. Among the testing genotypes 16 genotypes were erect, 15 genotypes were Semi erect, 3 genotypes were spreading growth habit and 4 genotypes were recorded as procumbent types. Purple colour anthocynonin pigmentation at nodes were recorded for 17 genotypes, Six genotypes had light purple colour pigmentation and 14 genotypes were not having and pigmentation.

Table 1. Characterization of Cenchrus genotypes based on Morphological Descriptors

S. No.	Morphological characters	States	Code	Absolute frequency	Relative frequency (%)
1.	Growth habit	1	Erect	16	43.24
		2	Semi-erect	15	40.54
		3	Spreading	2	5.40
		4	Procumbent	4	10.81
		5	Runner	-	-
		6	Creeper	-	-
		9	Other	-	-
2.	Anothcyanincolouration on nodes	0	Absent	14	37.83
		1	Purple	17	45.94
		2	Light purple	6	16.21
		3	Purple	-	-
3.	Node colour	0	No underlying visible colour due to anthocyanin	12	29.72
		1	Light yellow	11	29.72
		2	Green	14	37.83
		3	Others (specify in descriptor notes)	-	-
4.	Leaf blade altitude	1	Erect	26	70.20
		2	Horizontal	9	24.32
		3	Drooping	2	5.40
5.	Leaf blade pubescence	1	Glaborous	18	48.64
		2	Lax	16	43.24
		3	Medium hairy	-	-
		4	Dense hairy	3	8.10
6.	Awns distribution	0	Awnless	-	-
		1	Tip only	-	-
		2	Upper half only	-	-
		3	Whole lengths	37	100
7.	Awns colour	0	Awnless	-	-
		1	Whitish	-	-
		2	Straw	-	-
		3	Brown (tawny)	5	13.51
		4	Light green	3	8.10

S. No.	Morphological characters	States	Code	Absolute frequency	Relative frequency (%)
		5	Purple	29	7.83
		6	Black	-	-
		7	Others (specify)	-	-
8.	Leaf colour	1	Light green	12	32.43
		2	Medium green	16	43.24
		3	Dark green	9	24.32
		9	Others (specify)	-	-
9.	Early vigour	3	Poor	3	8.10
		4	Slightly poor	5	13.51
		5	Intermediate	10	27.02
		6	Slightly vigorous	4	10.81
		7	Vigorous	10	27.02
		8	Very vigorous	5	
		9	Extremely vigorous	-	

Table 2. Grouping of pigeonpea genotypes based on various morphological characters

S. No.	Genotype	Growth habit	Anthocyanin pigmentation	Node colour	Leaf blade altitude	Leaf blade pubescence	Awn distribution	Awn colour	Leaf colour	Early vigour
1.	FC TRY 1	2	1	0	1	1	3	5	2	7
2.	FDC 168	1	0	1	3	1	3	5	2	7
3.	VTCC-2	4	2	2	1	4	3	4	2	4
4.	FDC 135	1	0	2	2	1	3	5	1	8
5.	FDC 215	4	0	2	2	3	3	5	3	4
6.	FDC 232	1	0	1	1	3	3	5	2	6
7.	FDC 227	1	0	1	2	1	3	5	3	6
8.	VTCC-5	3	1	0	3	3	3	5	1	3
9.	FC-7	1	0	2	2	3	3	5	1	5
10.	VTCS 1	1	0	1	1	1	3	5	1	5
11.	VTCS-2	1	1	1	1	1	3	5	1	7
12.	VTCS-5	2	1	0	1	1	3	5	2	7
13.	FC-3	2	1	2	1	3	3	5	2	3
14.	White cenchrus	2	1	0	1	3	3	3	3	5
15.	FDC124	2	2	2	1	3	3	5	2	5

S. No.	Genotype	Growth habit	Anthocyanin pigmentation	Node colour	Leaf blade altitude	Leaf blade pubescence	Awn distribution	Awn colour	Leaf colour	Early vigour
16.	FDC 213	1	0	1	1	1	3	5	1	5
17.	VTCC-6	1	1	1	1	1	3	5	1	7
18.	FC-8	2	1	0	1	3	3	3	3	5
19.	CO1	2	1	2	1	3	3	5	2	3
20.	FC-5	2	1	0	1	3	3	3	3	5
21.	FC-9	4	2	2	1	4	3	4	2	4
22.	VTCS-3	1	0	2	2	1	3	5	1	8
23.	VTCC-4	4	0	2	2	3	3	5	3	4
24.	VTCC-8	1	0	1	1	3	3	5	2	6
25.	FC-6	2	1	0	1	3	3	3	3	5
26.	CO2	2	2	2	1	3	3	5	2	5
27.	FDC 222	1	1	1	1	1	3	5	1	7
28.	FC-1	2	1	0	1	1	3	5	2	7
29.	FC-4	4	2	2	1	4	3	4	2	4
30.	FC-10	1	0	2	2	1	3	5	1	8
31.	VTCC-1	2	1	0	1	3	3	3	3	5
32.	FC-2	2	2	2	1	3	3	5	2	5
33.	FC-11	1	0	1	2	1	3	5	3	6
34.	FC-14	1	1	1	1	1	3	5	1	7
35.	VTCC1,	2	1	0	1	1	3	5	2	7
36.	VTCC-3	1	0	2	2	1	3	5	1	8
37.	FC-13	2	1	0	1	1	3	5	2	7

Table 3. Parameters of variability in *Cenchrus ciliaris* genotypes

Characteristics	Mean SE	Range	CV (%)	CD(5%)
Plant Height (cm),	93.73±3.0	70.6-138.0	12.4	22.3
Leaf length (cm)	27.21± 1.2	16.4-43.1	8.9	13.4
Leaf width (cm)	1.22± 1.4	0.8-2.0	4.2	2.8
Inter-nodal length (cm)	5.85± 0.7	3.5-8.5	14.2	1.4
Nodes on tiller	12.18± 0.4	9.2-16.3	8.4	0.89
Panicle length (cm)	9.45± 1.8	4.8-12.6	9.7	2.45
Tillers/Plant	27.7± 1.8	9.0-50	17.4	18.42
Green fodder yield/Plant	241.06 ±14..2	80.0-499.6	61.9	24.78

Eleven genotypes had light yellow colour node, 14 genotypes had green colour node. Smooth leaf blade were observed for 18 genotypes, Medium hairiness were observed for 16 genotypes and 3 genotypes VTCC -2, FC-9, FC-4 were recorded dense hairiness. Awn distribution are in whole length for all the genotypes. The genotypes WHITE CENCHRUS, FC 8, FC 5, FC 6, and VTCC 1 recorded brown colour awns, VT CC- 2, FC 9, FC 4 were recorded light green awns. Twelve genotypes were recorded light green leaf, sixteen genotypes recorded medium green leaf and nine genotypes were recorded dark green leaf. Graham, T. W., [4] also observed the similar results. Early vigour was very vigorous for FDC 135, VTCS -3, VTCC 3. Similar characterization also done by Santhosh *et al.* [5] and Jayabharathi [6], (Table 2).

The genetic variability of *C*. *ciliaris* genotypes was analyzed for different quantitative and qualitative traits.(Table 3) Among quantitative traits, more variability was recorded for Plant height and Green fodder yield with the range of 70.6-138.0 and 80.0-499.6 respectively. Leaf length had the variation of 16.4 to 43.1, panicle length had the range of 4.8-12.6. The trait tiller per plant had wide variation of 9.0 to 50 among the genotypes. Same wide variation also observed by Jorge, M. [7]. Except leaf width other traits recorded wide variation between the genotypes [8-11].

4. CONCLUSION

Significant variation was recorded among the genotypes of *C*. *ciliaris* for most of the growth attributes studied except, leaf width. Plant height, No. of tillers plant and green fodder yield recorded significant critical difference between the genotypes. Hence utmost care would be given for these characters while in the selection process of *Cenchrus ciliaris* crop improvement.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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