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Agro-Morphological Characterization of Maize (*Zea mays* L.) Landraces from Tribal Block of Nandurbar District in Maharashtra (India)

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ABSTRACT

Agro-morphological characteristics of 19 maize landraces collected from tribal area of Nandurbar district were evaluated. A field experiment with 19 maize landraces was conducted in village level in-situ conservation center during Kharif season of 2016 and 2017. Data was recorded for 17 quantitative characters related to growth and yield performance and 20 qualitative characteristics. Most of landraces showed dark green coloured leaves (95%), straight attitude of leaf blade (78.9%), anthocyanin coloured anthers and silk (78.9%), conico-cylindrical ears (58%), yellow coloured grains (37 %) and flint type (94.7%). Among the plant growth characteristics plant height (157.4 to 208.9 cm), stem diameter (2.12 to 3. 94 cm), leaf length (69.06 to 95.56 cm) width (7.28 to 11.38 cm), ear length (14.to 22.22 cm) ear diameter (16.74 to 12.22 cm), number of rows per ear (12.4 to15.6.) contributed most in overall variability among maize landraces under study. Analysis of variance showed that all the characters were highly significant among the landraces.

Key words: *Genetic diversity, Morphological variability, Landraces.*

INTRODUCTION

Maize (*Zea mays* L., Family -Poaceae) is one of the most important crops in many countries being utilized as grains and fodder. Maize is emerging as third most important crop after rice and wheat, and contributes 2.5 billion dollar to Indian agriculture GDP[3]. As maize is being cultivated in diverse agro-climatic conditions, it is characterized by number of landraces which are adapted to local climate. In India, maize landraces are widespread in diverse agro-climatic zones, extending from the extreme semi-arid to sub humid and humid regions[8]. Crop landraces are the cultivated crop types with the highest genetic variation as well as with the best adaptation to the natural and anthropological environment where they have evolved[5]. They contain locally adapted alleles and represent irreplaceable bank of highly co-adapted genotypes[9]. Information on both qualitative and quantitative morphological traits of existing maize landraces may be useful in maintaining their genetic variability and preserving them from genetic erosion[4].

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There is an important role of morphological data in respect to identification, characterization as well as management of germplasm collection. Many tools are now available to study relationships among cultivars, including various types of molecular markers; however, morphological characterization is the first step in the description and classification of germplasm[12]. The characterization of morphological variability is useful tool to identify accessions with desirable characteristics such as earliness, disease resistance, or improved ear trait[11]. The objective of present study was to analyze morphological variability among maize landraces collected from tribal block of Nandurbar district of Maharashtra, India.

MATERIAL AND METHODS

Nineteen landraces of maize have been collected from native farmers in Dhadagon and Akkalkua block of Nanadurbar District. The geographical location of the experiment site was $21^0$48’49.0” N latitude; 074˚11’53.0” E longitude and at an altitude of 439 m above sea level. The average rainfall is 600 mm. The grains were sown in village level *in-situ* conservation center established under Maharashtra Gene Bank Program.

The experimental soil was medium type with normal pH; nitrogen and potash. Total of 19 landraces were sown in a plot size of 5 m x 4m each replicated three times in a randomized block design. The landraces were sown during the month of July 2016 and 2017 at a row spacing of 60 cm and plant to plant spacing of 20 cm. The recommended agronomic package of practices was followed during the crop growth period. The visual observations were recorded on 17 qualitative traits (leaf hairiness, leaf colour, stem colour, angle between leaf blade and stem, attitude of leaf blade, anthocyanin colouration at base of tassel glumes, anthocyanin colouration of anthers, angle between tassel main axis and lateral branches, attitude of tassel lateral branches, anthocyanin colouration of silks, ear placement, ear shape, type of grain, colour of grain, anthocyanin colouration on glumes of ear, kernel row arrangement, kernel opaqueness) and some of the qualitative traits like popiness and sweetness were recorded after cooking the landraces. Quantitative traits *viz*. plant height, stem diameter, leaf width and length (leaf below upper ear), tassel length, ear diameter, ear length as well as other traits like days to 50 % tassel anthesis, days to silking, maturity days, grains per row, rows per ear, 1000 grain weight and grain yield were recorded. Analyses of variance were performed on each morphological data to test the significance of variation between accessions by using DBSTAT software.

RESULTS AND DISCUSSIONS

The importance of maize germplasm characterization has been highlighted by number of studies[10,7,2]. In the present study, the morphological diversity pattern of 19 maize landraces, with their agro-morphological traits were analyzed. The existing diversity was evaluated based on 34 morphological traits in19 maize landraces.

I) Qualitative traits: The observations on qualitative traits revealed that about 95 % landraces had dark green coloured leaves and 37% landraces had brownish tinge on stem at ground level. 52.6 % landraces had narrow angle between leaf blade and stem. Most of landraces (78.9 %) showed straight attitude of leaf blade as well as anthocyanin colouration on tassel glumes and anthers. Majority of landraces (57.9 %) showed narrow angle between tassel main axis and lateral branches while 73.7 % landraces had curved attitude of tassel lateral branches. About 95 % landraces had anthocyanin coloured silks and flint type grains. The ear placed on plant either at middle (84. 2%) or at low height (15.8%). Studied landraces showed conico-cylindrical (58%) and cylindrical (42%) ear shape. 80% landraces showed light purple anthocyanin colouration on ear glumes. Grain colour is the most variable character observed; about 37 %

landraces had yellow colour grains and other landraces with grain colour like white, red, red with yellow tip, blackish and brownish. Straight kernel row arrangement was found abundant trait with about 89.5% frequency. The cooking quality of grains like poppiness and sweetness was also evaluated. After roasting it was found that only M-80 and M-81 landraces were having poppiness. M-18 and M-13 landrace hadn't sweet taste while remaining 17 landraces had sweeter taste. About 21% landraces had kernel opaqueness. Although all these accessions were collected from same geographical area they possess higher degree of variability.

II) **Quantitative traits:** The mean values of quantitative traits revealed traits are presented in table -1. The evaluation of 15 quantitative traits for 19 maize landraces, showed the variation in plant height (157.4 to 208.9 cm), crop maturity days (91 to 123 days), days to silking (48 to 58 days) and grain yield per hectare (1114 to 1514 kg). The findings of the present study in Table 1 showed that stem diameter was most varied trait (17.39%), followed by grains per ear (17. 23 %) and tassel length (15.2%). Among the studied traits, days for tassel anthesis showed the lowest variation (8.3%). The stem diameter among different landraces varied from 2.12 to 3. 94 cm. The leaf width and leaf length ranged between 7.28 to 11.38 cm and 69.06 to 95.56 cm respectively. The days required for 50% tassel anthesis were highest (58.2 days) in M- 79 and lowest (42.8 days) in M- 88. Tassel length was lowest (19.46 cm) in M-03 and highest (25.16 cm) in M-86.

The post-harvest ear characters like number of ear diameter, ear length and kernel rows per ear, number of kernels per row and 1000 grain weight were evaluated. An average 1000 grain weight was 235.01 g; average 36.56 kernels per row and 13.56 rows per ear were recorded. Lowest ear length (14.76 cm) and the highest ear length (22.22 cm) were observed in M-01and M-22 respectively. Landrace number M-18 and M-81 had displayed highest (16.74 cm) and lowest (12.22 cm) ear diameter respectively. The number of kernels per row varied from 26.2 (M-81) to 44.2 (M-86) as well as number of rows per ear ranged from 12.4 to15.6. Minimum and maximum days required for crop maturity were recorded as 91.60 to 122.6 days respectively. 1000 kernel wt. ranged from 204.16g (M-92) to 286.74 g (M- 82). Among the morphological characteristics plant height, stem diameter; leaf length and width, ear length and diameter, number of rows per ear and grain colour, contributed most in overall variability among maize landraces. Wasala *et al*.[14] studied morphological characters in multi-location trial for 48 landrace accessions of maize. They also observed that grain yield, ear diameter and kernel weight showed significant differences among accessions.

Crop maturity days are important trait in breeder's point of view as landraces with minimum maturity can be explored in development of early variety. Some traits are directly contributing in grain yield like ear length, ear diameter, rows per ear etc. Grain colour is one of the diverse traits which may facilitate for discrimination of germplasm. Among the studied maize landraces some of the landraces exhibit some of these desirable traits which have more importance in breeding new varieties. Galarreta and Alvarez[1] also suggested that the traits like days to flowering, plant height and ear placement height, ear length, ear diameter, no. of rows per ear are more suitable for characterization and classification of maize landraces. Takawale *et al.*[13] suggested that the unexploited maize germplasm from tribal areas of the country can be tapped and utilized for further breeding programme.

Table 1: Mean values of quantitative traits of maize landraces

Landrace No.	Stem diameter (cm)	Leaf width (cm)	Leaf length (cm)	Days for 50 % Tassel Anthesis	Tassel length (cm)	Maturity days	1000 Kernel wt.(g)	Ear length (cm)	Ear diameter (cm)	Grains /row	Rows/ ear
M-01	3.94	9.66	82.16	53.4	19.46	103.20	236.1	14.76	13.26	35.8	12.4
M-03	2.68	7.34	81.28	54.0	21.64	91.60	251.88	16.42	15.08	37.4	13.6
M-13	2.66	11.38	95.56	55.0	20.06	96.80	230.36	17.7	16.14	42.6	13.2
M-18	2.66	11.38	95.46	55.0	20.10	98.60	242.66	14.78	16.74	27.4	15.6
M-22	2.86	8.56	74.14	48.0	22.36	108 .0	251.14	22.22	16.0	43.0	14.8
M-77	2.12	7.28	76.6	47.60	21.56	96.60	252.84	20.92	15.72	36.6	14.0
M-78	2.8	8.30	79.20	52.60	22.20	105.0	210.08	17.42	15.88	33.8	12.8
M-79	3.44	8.54	74.36	58.2	23.36	115 .0	217.82	17.84	16.1	38.6	13.6
M-80	2.70	9.62	78.84	53.20	21.54	103.0	236.86	15.76	14.62	26.0	12.4
M-81	2.58	8.84	79.44	48.6	22.36	118.8	256.12	15.72	12.22	26.2	12.4
M-82	2.62	8.86	81.10	52.20	24.28	114 .0	286.74	21.2	16.0	43.4	14.8
M-83	2.58	8.70	86.16	54.0	22.02	115.60	239.30	15.16	13.72	33.4	12.8
M-86	2.84	8.56	74.60	48.80	25.16	117.6	244.74	21.58	16.46	44.2	15.2
M-87	2.26	9.16	69.06	43.20	19.74	122.60	237.58	18.4	16.16	41.0	13.6
M-88	2.26	8.18	71.1	42.8	19.08	118.80	217.02	16.52	16.18	39.0	13.2
M-89	2.0	8.78	74.04	57.0	22.16	121.40	208.22	15.24	13.12	29.4	12.4
M-90	2.46	8.58	72.3	48.00	21.82	115.6	237.52	16.42	13.56	39.0	12.8
M-91	3.28	8.76	72.50	48.80	22.14	113.0	240.0	16.54	13.32	43.4	14.4
M-92	2.82	9.08	81.52	53.2	19.84	118.2	204.16	15.54	13.68	31.4	13.6
Mean	3.78	8.92	78.92	51.24	21.10	110.18	235.01	17.38	14.95	36.56	13.56
Range	2.12 to 3.44	7.28 to11.38	69.06 to95.56	42.8 to58.2	19.46 to25.16	91.6 to122.6	204.16 to286.74	14.76 to22.22	12.22 to16.74	26 to44.2	12.4 to15.6
SE (m) ±	0.451	0.110	0.753	0.435	0.329	0.970	2.014	0.269	0.162	0.646	0.144
CV %	17.39	12.0	9.3	8.3	15.2	8.6	8.4	15.09	10.56	17.23	10.36
p<0.01	**	**	**	**	**	**	**	**	**	**	**

CONCLUSION

Present work highlights the vast agro-morphological diversity between studied landraces. Some of the characters like days to maturity, ear length and diameter, grains per row and 1000 grain weight are very useful in development of trait specific maize varieties. The findings of the present study may provide a source of data related to variation required for future breeding programs.

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