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Full Length Research Paper

Collection, characterization and evaluation of sorghum (*Sorghum bicolor* (L.) Moench) landraces from South omo and Segen peoples zone of South Nation Nationality Peoples Region, Ethiopia

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ABSTRACT

Ethiopia is one of the centers of origin and diversity for a number of crop species, among which sorghum has a wide range of distribution in the country. The wealth of genetic diversity in the explored area consisted of drought tolerant, and bird-resistant species. Increasing sorghum grain yield partly requires developing cultivars that are adapted to drought stress environment. An experiment was carried out using 180 sorghum landraces collected from South omo and Segen peoples Zone in 2012 and 3 controls(2 improved varieties and 1 local check) grown during April to July, 2013, under rain faid condition at Alduba sub station of Jinka Agricultural Research center. Results of analysis of variance of 10 characters namely days to 50% heading, days to 95% maturity, plant height(cm), productive tiller number, panicle length(cm), peduncle length(cm), number of nod per plant, grain yield(kg/plot), 1000 kernel weight(g) and biomass (kg/plot) for 180 sorghum land races and 3 checks (controls) are presented in Table 1. All the characters showed significant (p<0.01) difference among the tested land races and controls. The presence of significance among landraces indicate the presence of genetic variability for each of the characters among the tested landraces.

Keywords: Collection, landraces sorghum.

INTRODUCTION

Plant genetic resources represent the inter- and intra specific reservoir of potentially useful genetic material. Landraces or farmer varieties constitute the basic material for developing any variety or hybrid. Landraces are the varieties nurtured and cultivated by the farmers through traditional method of selection over the decades. An autochthonous landrace is a variety with a high capacity to tolerate biotic and a biotic stress, resulting in high yield stability and an intermediate yield level under a low input agricultural system (FAO. 1998).

Field survey data of sorghum landrace populations grown by traditional farmers in four adjacent communities in the Ethiopian highlands were used to analyze and project the local risk of loss of individual landraces under three scenarios: wild population, traditional farming and agricultural modernization. The risk of loss in the wild population scenario is based on landscape ecology theory which evaluates total population size, spatial distribution and patch occupancy, with high values for each factor and the sum of the factors decreasing the risk. In the traditional farming scenario, the deliberate actions of farmers must be taken into account like farmers favour for various traits of the sorghum for specific reasons – yield, taste, storability etc., which will balance plant numbers according to quantity and quality requirements. In the agricultural modernization scenario, introduction of high yielding varieties tendency toward monocultures, use of agricultural chemical force the traits of the landraces that are most likely to be displaced and also bring in nature of the landraces that are likely to be retained on the basis of cultural or other factors (Teshome et al., 1997). Hence, the collection and protection of sorghum landraces is very important.

Sorghum [*Sorghum bicolor* (L.) Moench] is one of the most important cereal crops grown in arid and semi arid parts of the world. The crop can successfully grow in areas where are too marginal for major cereals. In Eastern Africa, more than 70% of sorghum is cultivated in the dry and hot lowlands where low soil fertility, poor stand establishment, in addition to serious water deficit are among the major production constraints (Mukuru, 1993). In Ethiopia, sorghum is grown as one of the major food cereals. It is utilized in various forms such as for making local bread (Injera) and for preparation of local alcoholic beverages (tela and areke). It is also consumed as roasted and boiled grain. Sorghum Stover is used as feed for animals and as housing and fencing material. Sorghum is annually cultivated on 1.3 million ha contributing 1.7 million Metric ton annual grain production in the country (CSA (Central Statistical Authority), 2003). It is grown in 12 of the 18 major agro-ecological zones including the lowland, mid and high altitude areas of the country. But it is predominantly cultivated in dry areas that cover nearly 66% of the total area of the country (Geremew et al., 2004).

There is diverse gene pool for sorghum in Ethiopia in general and in southern region in particular. Though some collections have been done by Melkassa Agricultural Research Center, all the existing gene pool has not yet been exploited from the sorghum niche of Southern region. South Omo and Segen areas peoples' zones are rich in sorghum landraces. Therefore, it is a paramount important to collect and maintain the sorghum accessions from the sorghum belt of the region. This will be used for further variety development program after characterization and evaluation identifying the promising ones from the collected landraces. The major objectives of the present study were 1) To collect and maintain the sorghum landraces from South Omo and Segen area peoples' zones, 2) To characterize and evaluate the landraces for future breeding program, and 3) To develop improved sorghum varieties with acceptable quality.

MATERIALS AND METHODS

Collection was done from farm field, threshing grounds, and farm stores. During collection the necessary pass port data was recorded. The collected landraces were maintained at Jinka Agricultural Research center and characterization and evaluation of the landraces collected from low land areas of the tow Zone were made at Alduba sub station of Jinka Agricultural Research Center whereas those from mid-altitude were maintained at on station of Jinka Agricultural research Center for further evaluation and characterization.

The experiment consisted of 180 land races and three checks (Teshale and Gubeye were used as standard checks with one local landrace). It was laid out in Augmented design in nine block. A plot consisting of four rows each 4 m long with spacing of 0.75m between rows and 0.15m between plant. The distance between blocks was 1m. Each landraces was sown at rate of 10 kg ha^{-1} on April 4/2013, and had Fertilizer rate of 100kg/ha DAP at planting and 50kg urea was applied at nee height in the row. Each plot was kept free from weeds with frequent hand weeding.

At physiological maturity, five random plants within each plot were manually uprooted to determine plant height(cm), panicle length(cm), pedicel length(cm), number of nod per plant and productive tiller number per plant. Grain yield(kg/plot), thousand seed weight(g) and total biomass(kg/plot) were determine after harvesting the two central rows. The data were analyzed using GLM procedure of SAS software (SAS, 1996).

RESULTS

Results of analysis of variance of 10 characters for 183 sorghum landraces and 3 checks (controls) are presented in Table 1. All the characters showed significant ($p<0.01$) difference among the tested land races and controls (Table 1).The presence of significance among landraces indicate the presence of genetic variability for each of the characters among the tested landraces. The ANOVA of contrast analysis between the landraces, controls and landraces vs controls is also presented in Table 1.

Data of the mean grain yield (kg/plot), total biomass(kg/m2), 1000 seed weight, panicle length(cm) and peduncle length(cm) are presented in (Tabel2). Landrace Diskara and Mashela had the smallest and landrace Keshmta and jerj had the largest panicle. Early maturing landraces typically had smaller panicles than the late maturing type. Significant differences in the length of peduncles were observed among the landraces, and the peduncles of mursi, ooa and chocha were the longest and those of gemba and dashela were the shortest. Short peduncles are disadvantage in terms of pest and disease sensitivity because insect and fungi tend to develop around the sheath of the flag leaf and extend to the panicle attacking the seed (Doggett, 1988). Significant differences were observed among the landraces in 1000 seed weight, the highest value of 1000 kernel weight 48.7 g was found from landrace bermugay and the lowest value 20.5g was obtained from landrace mursi.

There were significant difference between main stem height and number of internodes among the landraces

Table 1. Significance of mean squares for ten grain yield and yield related traits for 180 sorghum land races and two improved sorghum varieties.

Source of variati	df	DTH	DTM	PH	GY	BM	TKW	PL	TN	NNOD	PEDL
Blk(Adj)	8	1.65ns	48.00**	89.19ns	1.42*	573.24**	3.45ns	15.88ns	2.50**	2.88**	6.87ns
Tret(Adj)	182	22.01 **	79.36**	1363.7**	2.73**	787.8***	46.17***	36.27**	2.01***	29.22**	45.86**
Tests	179	92.56 **	76.15**	1287.82*	2.69 ***	773.21***	44.79***	15.51 **	2.00***	29.60***	38.41***
Controls	2	266.93**	404.33**	1025.31ns	6.28**	2042.11***	132.41**	26.42 **	1.33 ns	4.73*	344.55**
Tests vs controls	1	400.75**	3.35ns	15632.99**	3.01**	905.48*	0.26ns	61.66 **	5.48**	10.82**	2.31ns
Error	16	22.09	0.88	358.88	0.16	71.07	2.75	13.07	0.5	3.10	7.65
CV, %	-	7.07	0.71	10.64	22.12	11.09	5.00	23.34	29.9	19.39	21.5

*, **,*** = significant at $p < 0.05$ and $p < 0.01$, $p<0.001$respectively; ns = not significant df= degree of freedom, DTH= days to 50% heading ,DTM= days to 95% maturity, PH= plant height , GY= grain yield ,BM=biomass ,TKW=thousand kernel weight ,PL=panicle length, TN =tiller number ,NNOD=number of internodes , PEDL=peduncle length.

Table 2. Adjusted Mean values of ten grain yield and yield related traits of 180 sorghum land races and thee checks (two improved varieties of sorghum) grown under rain faid condition at Alduba sub station of Jinka Agricultural Research Center.

Landraces	DTH	DTM	PH	GY	BM	TKW	PL	NNOD	TN	PEDL
Teshale	57	124	161.7	2.7	62.7	38.4	15.0	7.7	3.2	15.3
Gubye	62	138	143.7	2.5	61.2	35.3	15.1	9.0	2.5	21.2
Local	68	137	162.6	1.2	88.0	29.4	12.1	8.7	2.5	3.47
orgo	66	136	234.3	3.1	55.4	29.5	15.0	14.5	3.4	9.8
deskera	65	137	249.5	0.6	85.5	28.5	13.8	10.1	4.4	13.6
Tiskaro	68	136	251.5	2.1	70.5	35.9	7.8	8.9	3.4	27.6
Huatta	68	136	170.2	2.5	70.5	36.5	12.8	6.7	3.4	12.3
onatta	70	136	263.3	0.7	80.5	25.5	13.5	2.8	5.4	4.4
megelotta	68	137	176.3	2.4	130.5	39.3	12.2	11.8	6.4	21.4
nechemeser	73	132	173.5	2.9	17.9	39.3	18.4	10.1	2.4	7.0
tikurkmeser	74	135	123.5	0.9	55.5	34.5	14.6	9.3	1.4	4.3
Tsurmula	75	141	111.9	1.3	84.5	33.5	11.0	8.1	6.4	3.8
messera	73	133	277.1	2.5	71.5	36.9	11.4	8.4	7.4	4.1
pichita	76	135	177.6	0.3	70.5	29.9	27.4	10.3	1.4	17.1
Aylayta	88	142	179.2	0.9	84.5	22.5	12.5	4.0	0.4	5.0
Desheqo	89	145	212.1	0.7	55.5	32.9	10.4	6.0	2.4	5.4
Ayullu	75	135	235.5	1.1	70.5	26.5	10.4	9.3	3.4	18.2
koyrytta	68	136	131.5	1.4	59.6	32.9	12.2	9.3	2.4	12.1
Kulshiya	60	139	275.3	1.7	40.5	30.5	12.3	6.3	3.4	5.0

Table 2 continues

Amata	85	150	205.5	0.6	62.9	29.4	9.61	2.4	2.4	14.6
Sayira	65	136	219.9	2.0	85.5	32.9	10.4	6.3	4.4	4.0
Shulita	72	137	143.9	0.1	55.5	24.4	11.4	6.3	5.4	6.9
Bulala	70	136	163.5	1.1	70.5	22.4	13.8	7.3	2.4	6.2
Arbore	73	138	218.7	3.1	83.1	44.8	19.5	11.3	1.7	12.3
Kembota	89	147	134.4	3.2	36.6	27.8	12.1	6.9	2.7	10.7
Magalo	63	136	218.9	5.9	36.6	39.8	17.9	10.8	1.7	9.5
Qodeno	75	139	134.4	4.7	66.6	31.9	9.7	7.9	2.7	6.1
Kolita	62	136	215.5	3.4	74.1	33.8	9.3	9.9	0.7	20.5
Erara	63	136	252.8	4.2	56.3	37.4	21.7	7.9	4.7	5.9
Ambesse	65	135	176.2	3.4	66.6	45.4	16.1	9.9	5.7	14.3
Gambella	67	138	201.5	4.1	66.6	36.4	14.7	9.7	4.7	15.7
whiteomorate	68	137	170.3	4.1	89.2	32.4	16.6	3.9	4.7	7.7
Kuito	59	137	160.6	2.7	145.4	40.8	14.7	6.9	3.7	8.8
Diskara	67	134	152.1	4.0	36.6	27.4	4.3	4.9	6.7	25.3
Kuilita	65	135	187.1	4.4	107.9	26.9	18.6	7.9	2.7	7.3
Red omorate	66	126	185.2	2.5	50.62	34.9	13.1	8.9	2.7	5.7
Sorgoga	74	138	123.9	3.5	59.6	30.9	25.3	5.9	1.7	25.1
Kodeno	60	135	310.3	2.5	60.6	43.3	12.2	4.3	4.7	7.8
Amedeta	65	136	158.5	4.3	74.1	19.8	10.6	8.9	1.7	7.8
Muruta	68	136	164.5	4.6	89.1	36.3	18.3	7.9	1.7	3.5
Ginassa	75	137	211.4	1.8	66.6	26.9	16.3	6.8	1.7	9.5
Hadyata	74	152	101.4	1.8	43.6	19.8	15.3	9.3	2.7	29.3
Klash	57	1342	105.3	0.1	59.9	20.4	14.3	10.1	4.7	23.3
gemmba	67	134	182.2	3.1	65.9	29.5	16.3	9.5	3.7	25.7
Jerjerte	64	136	241.5	1.3	77.9	44.6	16.5	7.7	4.7	16.1
Seblew	94	154	138.3	0.9	74.9	30.0	11.1	6.1	0.2	19.3
Hagiteta&gend	64	138	182.4	0.3	72.9	25.1	19.5	11.1	0.7	16.9
Chage	68	137	250.1	0.9	74.9	36.0	15.4	7.9	0.7	13.5
Geshendo	75	144	173.8	0.6	66.9	23.3	21.7	13.1	0.2	18.0
Konada dima	66	138	278.1	1.6	61.9	44.5	20.9	12.1	1.7	30.5
Tomay	73	135	257.4	2.0	77.9	25.9	12.0	8.1	0.2	20.9
borozaytta	95	155	173.2	0.8	89.9	36.5	11.5	8.2	0.2	19.9
Achereyakedo	65	136	148.5	1.3	85.9	23.2	18.5	11.5	1.2	13.5
hufee	64	135	232.3	0.6	89.9	35.0	12.7	10.1	0.7	25.1
Ooa	62	138	251.3	1.3	86.9	26.3	12.1	7.1	2.2	24.5
Emado bure	63	123	189.5	2.2	97.5	34.5	13.1	9.1	0.7	18.0
Gabatakuma	61	134	172.9	1.1	86.9	32.1	16.9	10.1	0.7	19.9
Emodo hadera	63	135	272.1	1.8	62.9	38.5	13.9	13.1	0.7	23.9
Losoro	57	137	283.3	1.9	101.9	35.6	9.7	7.7	0.2	21.7
chocha	62	124	143.9	0.6	128.2	34.5	13.1	8.1	1.8	23.9

Table 2 continues

konkota	61	130	182.9	0.2	57.9	38.1	10.3	12.1	0.2	9.81
nirfo	70	133	189.5	0.02	56.9	36.6	10.3	10.1	2.4	10.1
burnaso	55	135	153.9	0.06	51.9	34.7	7.8	7.7	1.4	5.5
wayqochu	60	134	153.1	0.1	62.9	20.0	13.8	8.7	3.4	14.5
Emado geleba	57	125	184.1	0.9	50.9	36.7	12.8	9.7	1.4	16.0
Garite	57	126	173.1	0.9	77.9	42.6	8.8	8.7	2.4	6.6
Jinbota	60	127	181.1	1.7	47.9	42.6	14.2	9.7	1.4	8.6
Hutako	57	122	176.1	1.6	52.4	41.7	14.2	8.9	2.4	10.4
Qado	57	125	178.3	1.4	56.9	39.6	15.8	8.4	2.4	9.41
Lokal	56	133	192.9	0.9	65.9	38.7	15.0	8.1	2.4	12.4
Epahta	55	122	186.3	2.2	59.9	20.6	14.6	7.7	1.4	15.0
nagoge	54	130	183.3	0.7	37.5	27.2	14.8	8.3	0.4	10.8
Dochi	59	135	184.3	2.4	59.9	33.6	12.8	7.9	3.4	10.0
Garga	65	131	137.5	1.9	101.9	45.7	12.2	10.7	3.4	8.4
gimbrichi	68	135	182.1	2.3	44.9	29.6	15.8	8.5	8.4	12.6
Jewqeji	60	137	135.6	4.8	115.5	39.7	15.8	14.7	5.4	16.6
Bazgala	55	134	178.5	2.5	44.9	33.6	17.0	7.1	4.4	11.6
Nala	67	135	191.9	1.1	74.9	34.7	12.1	10.7	3.4	17.6
mursuqa	72	136	197.3	1.0	68.9	37.6	17.4	11.9	3.4	12.6
tanga	57	134	195.7	0.8	44.9	28.7	17.3	8.7	4.4	16.6
Abeto	56	136	174.1	0.3	22.5	31.6	17.4	8.4	5.4	11.6
Aunta	72	135	181.5	0.4	57.9	32.1	17.2	6.7	2.1	17.6
Ugama	75	134	153.1	0.4	87.9	41.5	16.2	10.1	4.1	12.4
AmaroHamer	61	135	174.0	1.6	51.9	33.0	10.8	8.1	3.1	13.6
zoo	75	113	112.0	2.4	42.9	29.5	17.4	11.6	2.1	17.2
Orgente	74	112	170.6	0.7	42.9	32.0	17.3	10.5	0.1	8.2
Dea	74	111	133.2	0.3	51.9	35.5	21.1	8.1	0.1	20.4
murs	83	111	173.13	3.6	42.9	39.0	19.4	8.9	2.1	14.1
Gorda	73	115	205.0	2.0	59.9	21.5	17.4	7.9	0.1	7.9
Akedo	89	111	187.4	2.2	72.9	29.0	15.4	6.1	0.1	5.97
Alepha	81	143	138.6	1.9	87.9	28.5	26	10.1	3.1	16.9
Male	76	134	193.0	1.7	113.5	42.5	21.4	10.6	2.1	9.97
Lomeniboqo	56	108	212.4	3.2	101.4	39.5	23.8	10.2	4.1	15.7
Argo	57	134	155.6	3.2	161.5	41.5	10.4	10.7	1.8	10.5
Karo	87	119	161.0	1.1	96.9	27.5	12.6	8.7	2.1	11.3
Ar	58	113	172.4	0.5	189.9	43.5	12.6	9.1	3.1	20.9
Sibe	60	121	187.6	0.4	56.5	41.5	15.0	10.6	0.8	14.7
Batiqa	60	142	226.8	2.6	94.9	42.5	16.8	7.7	2.8	8.5
Eliyte	58	120	195.4	0.5	50.9	30.0	16.2	9.6	2.1	8.9
Gabo	61	118	132.0	0.2	42.9	36.5	16.2	7.5	1.1	9.1
Hukuma	62	137	169.6	4.8	75.9	44.0	12.0	8.5	0.7	7.9
Delgo	63	119	90.4	0.02	57.8	36.3	12.0	9.2	0.7	14.3

Table 2 continues

Bermugay	60	115	148.6	5.7	78.8	48.7	17.6	11.5	0.2	22.1
emado	61	114	198.4	3.1	51.8	33.3	11.9	9.1	0.2	6.5
galshi	67	135	135.5	1.9	57.8	37.4	21.8	9.0	0.2	5.3
chwlo	53	114	138.9	2.8	72.8	36.3	8.0	9.5	0.2	7.5
turmi	59	120	118.9	0.7	87.8	38.4	7.0	9.9	2.8	1.0
litinro	54	116	145.4	1.9	140.3	35.3	9.0	8.5	1.7	10.6
Ade	61	119	162.2	0.2	87.8	33.4	9.0	5.7	0.7	8.6
logengiro	64	114	203.5	4.9	85.6	44.3	13.0	8.3	1.8	8.1
karaluay	52	112	208.7	3.3	43.0	30.4	13.4	9.5	1.7	4.6
loyaluka	58	116	205.1	1.4	80.3	34.3	15.	9.6	0.8	19.6
nigabite	64	110	130.3	2.2	120.8	33.4	15.4	4.7	1.7	14.8
chelpila	52	110	118.2	2.5	137.3	30.3	8.5	10.1	1.7	14.0
kulit	61	102	143.8	1.1	111.8	36.4	7.8	9.1	1.7	10.1
arkume	53	111	137.4	2.3	120.8	24.3	20.9	9.2	1.7	8.1
anchum	58	114	174.2	1.9	75.8	39.4	15.8	9.0	0.7	9.2
peten	64	104	183.3	1.3	139.8	34.3	20.6	9.1	0.7	6.6
jaja	56	104	127.0	1.2	108.8	40.4	16.8	8.2	0.7	11.6
batada	53	107	189.2	0.7	48.0	19.3	15.6	10.1	0.7	6.6
liwan	81	164	155.8	3.3	65.3	22.4	14.4	10.1	0.7	10.8
gote	65	135	173.3	0.9	75.5	42.4	14.0	9.4	0.7	8.6
aborigne	58	136	167.0	0.9	37.9	34.4	13.1	10.7	2.8	7.8
kaykeye	57	132	140.8	1.7	102.4	35.4	16.1	8.8	2.8	5.8
mana	54	111	153.1	3.9	129.4	38.4	12.8	7.8	3.8	8.6
lodekegna	55	133	164.1	2.0	97.9	37.4	18.3	7.4	4.7	7.0
harich	56	107	150.9	2.9	142.9	38.3	15.2	7.0	3.7	13.2
hudo	60	108	160.2	0.4	138.4	39.7	17.3	6.2	3.7	15.9
malta	81	132	187.3	5.6	108.5	43.0	12.2	7.8	2.7	14.7
bukura	52	111	142.0	5.2	142.9	27.2	8.7	5.8	1.7	17.6
mursi	62	136	157.3	2.8	178.9	29.9	14.4	6.8	2.1	32.2
walaro	68	153	199.2	0.6	135.5	46.4	9.5	6.8	2.1	16.47
waitemursi	50	139	149.8	2.0	52.9	31.9	17.9	7.8	4.1	5.3
dirkacho	61	125	175.7	1.4	154.9	26.9	12.8	13.8	2.1	13.6
ducho	75	138	178.9	1.5	112.9	33.4	16.8	9.8	1.1	22.0
zimbale	60	135	254.4	2.3	105.5	35.4	19.9	7.0	2.1	18.6
walar	81	112	189.4	1.3	157.9	30.4	18.5	7.4	2.1	20.8
agumo	67	138	179.4	0.4	154.9	37.4	17.1	12.0	1.1	16.8
dinta	56	135	199.4	3.3	90.5	35.4	17.9	7.8	2.1	9.67
picha	56	112	175.0	0.6	102.5	36.4	15.1	8.8	2.1	19.8
bernas	60	138	197.1	0.5	48.4	33.9	21.9	6.8	2.1	18.1
adqera	64	138	176.6	0.5	65.5	31.1	16. 8	7.8	2.1	25.2
dashela	62	136	182.3	0.7	76.4	31.6	15.9	7.6	2.1	2.7
mur	86	114	131.1	0.4	58.5	20.5	18.1	11.2	2.1	9.8

Table 2 continues

delga	67	125	163.7	0.3	61.5	31.1	13.3	6.8	2.1	17.2
blarbore	60	136	210.1	1.2	51.5	23.6	16.5	9.8	3.2	5.07
tute	81	157	174.7	1.4	61.5	21.7	12.9	6.8	2.1	9.07
todede	65	114	172.9	0.5	66.5	30.7	12.3	9.8	2.1	17.2
mono	76	137	185.3	0.6	56.5	37.6	11.1	11.8	2.3	13.2
qonta	63	135	162.1	1.0	93.5	22.1	14.0	8.8	2.1	11.2
tepepa	71	135	220.7	1.8	64.5	35.1	10.1	10.8	2.3	2.0
zengada	62	134	261.1	0.9	60.5	37.2	15.1	7.2	2.1	3.74
dashecha	68	139	151.3	1.4	78.9	38.1	18.7	5.6	2.1	6.04
gababo	94	167	157.5	0.7	759.5	25.7	13.9	9.6	2.1	16.2
whidisko	50	130	236.7	0.3	60.5	27.4	13.7	5.8	2.1	13.8
gemba	60	131	165.1	0.3	51.5	26.1	18.5	8.8	3.2	2.7
korayta	92	147	246.5	0.5	87.5	35.2	11.5	6.8	3.2	6.8
huaa	66	135	171.9	3.6	91.9	20.5	10.3	10.0	4.3	23.6
jojama	49	134	184.1	2.5	73.5	23.8	15.3	5.6	2.1	12.2
dendo	62	131	142.6	0.3	51.5	36.2	5.5	8.2	2.1	11.24
riako	84	165	239.9	0.4	79.3	37.2	6.6	8.8	5.1	18.64
gunqo	84	154	171.9	1.3	94.3	23.7	13.5	9.6	0.7	4.84
unno	84	132	145.1	0.9	34.3	34.9	12.3	12.8	0.7	7.04
allo	71	139	194.1	0.5	89.3	35.4	13.7	8.8	0.7	14.24
ripi	91	153	171.1	0.4	79.3	34.9	20.3	11.8	3.7	3.34
mashla	49	123	196.9	0.5	88.3	23.32	3.0	6.8	2.7	14.24
morota	77	144	139.9	2.3	94.3	28.9	25.2	8.8	2.7	10.04
dade	72	137	175.2	1.3	79.3	21.3	25.8	9.8	1.7	12.14
kentera	74	133	186.7	0.6	79.3	29.9	25.8	9.3	2.7	7.34
keshmta	72	136	177.9	0.3	44.3	39.9	29.2	9.0	2.7	8.14
pulala	62	132	224.7	0.3	73.3	25.9	26.9	8.8	2.7	4.14
rara	83	149	193.8	0.2	92.3	30.9	16.8	6.8	2.7	16.74
derash	88	153	176.1	0.2	88.3	23.5	32.0	5.8	2.7	12.54
kerya	62	130	161.9	0.5	80.8	19.9	25.0	5.8	3.7	16.34
Asnaqech	48	104	185.9	5.1	56.8	27.9	26.6	7.2	3.7	16.94
Rokoke	49	107	138.9	0.9	79.3	26.9	21.9	5.6	1.7	16.14
Maryatta	62	133	139.6	0.5	41.8	36.8	27.7	9.2	2.7	11.54
Redqonado	64	136	144.9	0.2	82.3	30.9	25.1	9.8	2.7	12.54
areg	64	133	238.6	0.8	82.3	28.7	29.6	7.8	2.7	14.04
jerj	63	136	146.1	0.7	67.3	38.5	28.0	10.8	2.7	15.74
gundessa	71	143	139.9	0.7	60.4	38.5	21.1	5.8	2.7	20.94
dero	65	134	156	0.4	65	34	14	6.7	3.6	34.54
roma	56	156	137	0.5	64	32	12.5	5.1	2.6	12.54

df= degree of freedom, DTH= days to 50% heading ,DTM= days to 95% maturity, PH= plant height , GY= grain yield ,BM=biomass ,TKW=thousand kernel weight ,PL=panicle length, TN =tiller number ,NNOD=number of internodes, PEDL=peduncle length.

Table 3. Standard error and critical differences among two tests ,controls and test vs control

Critical differences b/n	DH		DTM		PH		GY		BM		TKW		PN	
	SED	CD(5%)	SED	CD(5%)	SED	CD(5%)	SED	CD(5%)	SED	CD(5%)	SED	CD(5%)	SED	CD(5%)
Two control trt	2.2	4.5	0.4	0.93	8.9	18.93	0.19	0.39	3.97	8.42	0.78	1.66	1.7	3.61
Two test trt b/n the same block	6.6	14.07	1.3	3.8	26.79	56.79	0.56	1.19	11.92	25.27	2.34	4.97	5.11	10.83
Two test trt d/f bloack	7.66	16.24	1.5	3.2	30.94	65.58	0.65	1.37	13.77	29.18	2.62	5.56	5.90	12.51
A test trt and a control trt	5.66	11.79	1.1	2.4	22.47	47.65	0.47	1.00	10.0	21.2	1.9	4.06	4.28	9.09

DTH= days to 50% heading ,DTM= days to 95% maturity, PH= plant height , GY= grain yield ,BM=biomass ,TKW=thousand kernel weight ,PL=panicle length

(Table 1). Plant height varied from 90.4 cm to 310.4cm for the landrace Delgo and kodeno, respectively. Number of internodes ranged from 2.8cmto 13.8 for the landrace onatta and Dirkacho, respectively. Landraces also showed considerable variations for days to 50% heading days to maturity and tiller number per plant.

DISCUSSION

Collection and evaluation of Sorghum landraces are basic to sorghum improvement programs for sustainable agriculture. Adequate characterization for agronomic and morphological traits is necessary to facilitate utilization of landraces by breeders. To achieve this, landraces of all crops are characterized for morphological and agronomic traits in batches over the years (Upadhyaya et al., 2008).

There is great variability in sorghum, making selection possible for most traits of economic importance. Landraces, in the form of breeding stock, collected accessions, and converted tropical cultivars, now moves readily worldwide and has contributed significantly to the crop's improvement in terms of yield, resistances and utilization/quality traits (House, 1985).

In these collections, the sorghum landraces are mostly named with the village name prefixed to the landrace(ex. turmi, mursi, Gambella),landraces are also named based on the grain colour (ex. Nech mesersera, tikur mesersera etc.), use of the stem or grain (ex. *tinkesh* etc.) for various utilities. A similar observation was made by Teshome et al., 1997) because the grain color, grain size and grain shape were the leading morphological characters used by the farmers naming the sorghum landraces.

Analysis of 180 sorghum landraces using 10 morphological traits showed the presence of variations among landraces. Sorghum traits variations were also observed by Teshome et al., 1997. The high variations exhibited by plant height, days to 50% heading, days to 95% maturity, grain yield, 1000 seed weight, number of node, panicle length, peduncle length and tiller number indicate the potentiality of landraces as breeding materials. The variation in sorghum landraces for morphological characters has been reported by many researchers in different countries. The evaluation of 152 accessions collected from Rwanda showed that the sorghum from Rwanda grows very tall (up to 500 cm), and takes more days to flower during long days (rainy season) and less number of days during short days indicating strong photoperiod sensitivity. Enormous variation was observed for panicle and grain characters (Rao et al., 1999; Prabhakar et al., 2011; Grenier et al., 2004). In the study areas seed exchange among farmers is the major factors for high variation among sorghum landraces. A study conducted by (Nathaniels and Mwijage, 2000) revealed sorghum seed exchange among farmers contributing sorghum landraces variability. (Table 1). Plant height varied from 90.4 cm to 310.4cm for the landrace Delgo and kodeno, respectively. Number of internodes ranged from 2.8cmto 13.8 for the landrace onatta and Dirkacho, respectively. Landraces also showed considerable variations for days to 50% heading days to maturity and tiller number per plant.

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CONCLUSION

From this study, it's clear that South omo and segen peoples zone of South Nation Nationality Peoples region of Ethiopia are the main sorghum belt areas of the region. Farmers maintain landraces that are unique in their adaptation, food quality, grain yield and biotic stress resistance. The collected landraces will be utilized for different research activities in national sorghum improvement programs for increasing production and productivity of the crop. And since the region has a high agricultural potential, productivity for better food security could be improved by use of locally available landraces adapted to this particular environment.

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