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Variability, Heritability and Genetic Advance for Oromo Potato (*Plectranthus edulis*) Accessions at Horro and Guduru Districts, Western Ethiopia

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Keywords

Plectranthus edulis,
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Abstract

A field experiment was conducted during the cropping season of 2007/2008E.C. on 20 accessions of Ethiopian potato /Oromo potato (Plectranthus edulis) collected from Western parts of Oromiay. The objectives were to evaluate the phenotypic variability of the accessions and identify heritability and genetic advance of the traits. All accessions grown in two row plots in randomized complete block design with three replications on two environments. 13 morphological characters were recorded. The collected data was subjected to ANOVA. The result showed most characters were significant ($P \leq 0.05$) on combined analysis. Individual location analysis also carried out and all characters except flower length and leaf width showed highly significance ($P<0.01$) at both environments. The mean performance of the genotypes indicated that the highest tuber weight per plot (6.75 kg/plot or 225quntal/hac.) was recorded from LUK/07, while low tuber yield of (0.5kg/p or 66.7quntal/hac.) was obtained from 02 ROB/07 at Gitilo. At Guduru the highest tuber weight per plot (7.2 kg/p or 240qunta/hac.) was recorded from BS102 and the lowest yield of (0.58 kg/plot or 72quntal/hac.) was obtained from 02 ROB/07) than the other accession. Higher GCV and PCV values were observed for tuber weight per plot, tuber length, number of marketable tuber per hill, number of stem per hill**,** number of brunches per stem and leaf length at Gitilo; at Guduru, flower length, tuber diameter, tuber weight per plot, tuber length, number of marketable tuber per hill**,** number of stem per hill, number of brunches per stem and leaf length had relatively high genetic advance as percent of mean and high heritability; hence, they can be used as a selection criterion, but ultimate evaluation must be performed in the target environment prior to using them. Lowest GCV and PCV values (< 5 %) were observed for number of brunches per stem at Guduru. The high PCV and GCV observed are evident from their high variability that in turn offers good scope for selection. This means that effective and satisfactory selection for practical improvement of these important traits.

Introduction

Plectranthus edulis is an indigenous annual tuber crop grown widely in the central, southern, western, northwestern and southwestern parts of Ethiopia (Uphof, 1968; Westphal, 1975; Zeven and Zhukovsky, 1975; PGRC/E, 1986; Edward, 1991; Edossa, 1996; Abdissa, 2000; GRIN, 2005). It is a dicotyledonous plant and

belongs to the family Lamiaceae/Labiatae; subfamily Nepetoideae and tribe Ocimeae (GRIN, 2005). In different growing areas of Ethiopia, different vernacular names are used for *P. edulis*. Among these are 'Dinicha Oromo' in Oromia, meaning "potato of the Oromo people" (Abdissa, 2000), 'Wolaita Dinich' (potato of the Wolayita people) around Wolaita (Endale, 1997), 'Agew Dinch' (potato of the Agew people) in the northwest and 'Gurage Dinich' (potato of the Gurage people) around Gurage zone (Westphal, 1975). It has been stayed for long period of time with the above maintained parts of the country.

But production and consumption of the crop was declining with the introduction of Irish potato and the extension and advertisements given for Irish potato.
For generations, farmers in different parts of the country have been cultivating *P. edulis* primarily for its edible tuber. The leaves are also eaten by human as green vegetable in some regions (Abebe, 1988). Moreover, the edible tubers are good for people with asthma (IAR, 1980) and because of its abundant nectar; the plant is a good source for honey bee (Reinhard and Admasu, 1994). Despite its importance for food security and medicinal value, only limited research has been conducted on the crop (Abebe, 1988). On the other hand, changes in agricultural practices and environmental degradation are causing genetic loss in the local gene pool of this crop (Amsalu and Tesfaye, 2004). However, since the last few years, the crop has been declining in its production and productivity. Thus, a research project is being initiated with the following main aims. Access and analyses indigenous production practices and constraints, and socio-economic values in some parts of southern Ethiopia. Oromo potato is originated and domesticated in Oromiya regional state, South Western Ethiopia due to highest level of cultivated and intermediate between wild and cultivated (Tefera Tolera *et al*., 2011).

Oromo potato, the most important root and tuber crops in that it is productive per square meter of land and easy management. In contributing to solve problems of mal- and under- nutrition in South Western Oromiya and Ethiopia, through the utilization of crops known to farmers and for the promotion of neglected indigenous root and tuber crops, this project be important. The food potential of *P. edulis* has not yet been fully exploited and utilized despite their significant contributions towards food security, income generation, provision of food energy and resource base conservation. The low agricultural productivity, recurrent drought and socio-political factors have greatly contributed to critical food shortages in Ethiopia coupled with over-dependence on few cereal crops; thus, integration of *P.edulis* crops into the food system of the people given a serious attention. Due to the lower attention given to the research and development of Oromo potato, there is no variety so far developed and released. There are traditional selection practices being followed by farmers to have Oromo potato types of desirable qualities, such as larger tuber size. Therefore, the objective of this study was:

- To identify the superior genotype of the crop in yield and agronomic performance
- To identify variance components of the characters studied

Materials and Methods

The trial was conducted at two locations namely Gitilo and Guduru (Wollega University College of Agriculture and Natural Resources research site). Areas are characterized by long and short durations. Twenty accessions of *P. edulis* collected from Western oromiya Zones were planted in Randomized complete Block Design in three replications. Tubers was used as planting material for all accessions & planting material have similar size, all with three rings with medium size. Plot size was fixed at 2 meter long and 1.5 meter width and each plot would have 2 rows with five plants each and with row spacing of 60 cm. Spacing between plants was 40 cm and the plots was 0.6 m apart from each other and one meter between replications. In the designed plots, one tuber with three rings was sown per hill. Sowing was done on 1st June, 2015 for both locations. In the trial, organic fertilizer (FYM) was applied before one month of sowing date in all the plots by broad casting similarly (five t ha-1 FYM at all locations) as recommended at Bako Agricultural Research Center. Data was recorded on 12 quantitative variables using five randomly selected plants from plot of each accession. Harvesting was done when more than 90% of the plants in a plot show physiological maturity (at >90% leaves senescence).

Table1. Experimental materials used and area of collections

Entry No	Accession code	Area of collection Zone	District
1	AMU/07	H/G/Wollega	Amuru
2	IM/01	E/Wollega	Bilo
3	DEB/07	H/G/Wollega	Jimma genet
4	TESF/07	W/Shawa	Tibe
5	GOd23/07	E/Wollega	Billa
6	DOY2/07	H/G/Wollega	Horro
7	WB3/02	E/Wollega	G/Ayana
8	BS2/07	W/show	Ginchi
9	BS1/02	H/G/Wollega	Guduru
10	DOY1/07	H/G/Wollega	Horro
11	TSF1/02	E/wollega	Anno
12	LUk/07	W/Wollega	Gidam
13	01RB/02	W/Showa	Bako area
14	LUK2/03	W/Wollega	Arjo
15	02 ROB/07	E/Wollega	Bilo
16	LUK/07	W/Wollega	Arjo
17	55Gid/07	H/G/Wolega	Dedu
18	LUK01/07	W/Shawa	Gedo
19	Rob/02	H/G/Wollega	Alibo
20	HUSN/07	E/Wollega	Biila

Results and Discussion

The result of pooled analysis of variance shows there is highly significance difference between all genotypes (P<0.01). In addition, location effect was highly significant for 11 of the variables out of 13, one variable (number of stem per hill) shows none significance difference. In other case the interaction of genotype and location shows none significance for some of the characters (plant height, leaf width, flower length, number of stem per hill, number of node per stem, inter node length), significance ($P \leq 0.05$) for two of the characters (leaf length and tuber length) and highly significance ($P \leq 0.01$) for four important characters (number of tuber per hill, tuber weight per plot, tuber diameter and number of marketable tuber per hill) out of 13 characters. This indicates that these important traits are responding differently to different environment.

Table 4. Mean square analysis of variances for 13 characters analyzed in RCBD across the two locations

Variables	Df	PH	LW	LL	FL	NSPH	NBpS	Nnod	NodL	NTpH	TWpP	TL	Tdi	NMTpH
Gen.	19	398.8*	1.3**	17.7*	9.9**	2.1**	11**	6.7**	8**	1799**	23**	9**	2.6*	366**
Loc.	1	483**	1.1**	142**	145**	0.2^{ns}	60**	529**	20**	568**	640**	7.3**	1.4*	7.9**
GXLoc	19	29.7^{ns}	0.2^{ns}	1.94*	0.9^{ns}	0.3^{ns}	0.55^{ns}	1.25^{ns}	0.9^{ns}	1056**	20**	10**	0.8*	182**
Error	78	41	0.3	0.24	1.9	0.4	1.8	1.8	1.02	75	2	2.14	0.6	34
Mean		89	3	9.2	9.1	2	7	6.5	7.9	52.7	7.7	7.5	5.9	22.4
CV%		7.2	18.8	12	15.2	29	19.7	20.7	12.8	16.3	18	19.4	13	26.2

4.2 Range, Mean, Heritability, Genotypic and Phenotypic variance and Genetic advance

Estimated range, mean, and standard error of the mean presented in Tables 6 and 7 for Gitilo and Guduru, respectively. Wide ranges were recorded for tuber weight per plot, number of tuber per hill**,** tuber length, plant height, number of stem per hill, number of brunch per stem, number of nodule and stem inter nod length at Guduru, and for tuber length, tuber diameter, and flower length, at Guduru. The mean performance of the genotypes indicated that the highest tuber weight per plot (6.75 kg/plot) or 225ton/hac.) was recorded from LUK/07, while low tuber yield of (0.5kg/p or 66.7quntal/hac.) was obtained from 02 ROB/07 at Gitilo. At Guduru the highest tuber weight per plot (7.2 kg/p or 240qunta/hac.) was recorded from BS102 and the lowest yield of (0.58 kg/plot or 72quntal/hac.) was obtained from 02 ROB/07) than the other accession. Higher mean plant height (83 cm) recorded at Gitilo. At Guduru, mean plant height was (95.2 cm) because of high temperature and short growing season. The highest mean for tuber yield (7.2 kg/plot) and number of marketable tuber yield (24 /hill) were recorded at Guduru as compared to mean tuber yield (6.75 kg/plot) and number of marketable tuber yield (20.3 per hill) that were recorded at Gitilo. This indicated that the crop performance was much better at Guduru than at Gitilo.

Some of the genotypes had equal or higher tuber diameter at Gitilo in comparison to Guduru. Observation made in this study suggests that under moisture stress condition such as end of September and mid October, certain genotypes namely, DOY1, BS2/07 and 01WB/07 stayed greener and produced thick tuber at Gitilo Other genotypes had longer period of maturation and able to increase tuber girth as a result they had grater tuber weight per plot. Highest mean recorded for characters such as number of stem per hill, plant height, flower length and leaf width at Guduru.

Generally, low rainfall or drought stress can affect many traits such as tuber diameter, tuber weight and number of stem per heal (Richards *et al*., 2001). Nevertheless, the result obtained for number of stem per hill at Guduru had higher value, but high sun light during tuber initiation can affect the increment of tuber length, tuber diameter and generally on tuber yield. Especially, the number of stem per hill in plant is not proportion with productive tuber.

4.3 Phenotypic and Genotypic Variations

The amount of genotypic and phenotypic variability that exists in a species is of utmost importance in breeding better varieties and in initiating a breeding program. Genotypic and phenotypic coefficients of variation used to measure the variability that exists in a given population (Burton and Devane, 1988). Estimated variance component, phenotypic coefficient of variability (PCV) and genotypic coefficient of variability (GCV) of the characters studied at Gitilo and Guduru presented in tables 11 and 12, respectively.

Table 7. Range, mean, variance, heritability, genotypic and phenotypic coefficient of variability, genetic advance as percent of mean for the 13 characters of Oromo Potato Accesesions tested at Guduru

Characters	Range	Mean ± SE	σ2g	σ2 ph	h2 (%)	GCV (%)	PCV (%)	GA	GAas % Mean
PH	74.3-115	95.2±0.77	91	137.9	65.9	9.9	12.2	15.8	16
LW	0.3-2.6	2.6± 0.3	0.046	0.354	13	7.6	23	0.16	6
LL	7.75-15	10.3± 0.8	4.16	5.5	75.6	21	23.3	3.73	36
FL	7-13.3	10± 0.67	1.69	3.9	43.3	13	19.7	1.75	17.5
NSPH	1.16-4	2.1± 0.56	0.24	0.64	37.5	23.3	38	0.6	28
NBpS	5-9.5	7.7± 0.55	0.9	2.7	33.3	3.8	20.7	1.09	14
Nnod	5.3-11	8.6±0.5	1.04	4.12	25.2	11.8	24.4	1.08	12
NodL	6-11.3	8.4± 0.74	1.6	2.8	57.14	15	20.2	2	23
NTpH	22.3-91.6	55± 0.9	566	664	85.2	43	46.7	45	80
TWpP kg/p	5.6-16.7	10.1± 0.8	8.2	11.7	70	27.7	33.6	4.9	48
TL	3.6-9.3	7.2±0.6	1.2	3.4	35.3	15	25	1.3	18
TDi	4.5-7.25	5.8±0.7	0.4	0.88	45.4	10.3	15.5	0.84	14
NMTpH	10-42.6	20.3± 0.75	69	109	63.3	40.8	51.2	13.5	66

In study, the PCV values were greater than GCV values across environments although the differences were small. This indicated that the environmental effect was small for the expression of most characters. Among all characters, higher GCV and PCV values (>10%) were observed for tuber weight per plot, tuber length, number of marketable tuber per hill**,** number of stem per hill**,** number of brunches per stem and leaf length at Gitilo; at Guduru, higher GCV and PCV values were observed for flower length, tuber diameter, tuber weight per plot, tuber length, number of marketable tuber per hill**,** number of stem per heal, number of brunches per stem and leaf length. Lowest GCV and PCV values (< 5 %) were observed for number of brunches per stem at Guduru. Plant height at Gitilo and Guduru showed intermediate (>5% and <10%) coefficients of variability. Other yield components, as tuber weight per plot, tuber length, number of marketable tuber per hill**,** number of stem per hill**,** number of brunches per stem and leaf length had considerable variation at both locations.

4.4 Heritability

Estimated heritability for the characters considered at Gitilo and Guduru are presented in Tables 11 and 12, respectively. The heritability values were sufficiently high for most of the traits at Gitilo and Guduru, indicating the possibility of progress from selection. The high heritability values for most of the characters could attribute to the relatively favorable environment at both locations. Heritability estimates expected to be lower in poor environments where heritability concealed due to a greater genotype by environment interaction component

Table 8. Range, mean, variance, broad sense heritability, genotypic and phenotypic coefficient of variability, genetic advance as percent of mean for the 13 characters of Oromo Potato accesesions tested at Gitilo

Characters	Range	Mean±SE	σ2 g	σ2 ph	h2 (%)	GCV (%)	PCV (%)	GA	GA as % mean
PH	66.6-94	83.5± 0.65	36.9	78.3	47	7.2	10.5	8.5	10
LW	2-4.03	3± 0.53	0.08	0.41	19.5	9.3	21.3	0.25	8.3
LL	5.8-11.3	8 ±0.71	1.5	2.6	57.7	15	20	1.89	23.6
FL	5.6-10	8.2± 0.56	0.66	2.26	29.2	9.7	18.3	0.9	11
NSPH	1.2-4	2.2 ± 0.59	0.22	0.6	36.6	20.9	35	0.58	26
NBpS	4.3-8.6	6.3 ± 0.62	1.23	2.7	45.5	17.4	26	1.5	24
Nnod	3.3-6.3	4.4 ± 0.55	0.33	1.03	32	12.9	23	0.65	14.9
NodL	4.8-9	7.5 ± 0.66	0.73	1.43	51	11.3	16	1.26	16.8
NTpH	12-82	50.7± 0.8	335.7	387.7	86.5	36	38.8	35	69
TWpP kg	0.5-9	5.46 ± 0.9	4.9	5.37	91.2	40.3	42	4.3	78
TL	2.8-11	7.7 ±0.72	3.7	5.6	66	24.6	31	3.2	42
TDi	4.8-7.8	6.02 ±0.52	0.33	1.02	32.3	9.6	16.6	0.66	11
NMTpH	2.3-40	24 ±0.53	90.3	120.9	74.6	39.5	45.4	16.7	69.7

Tuber weight per plot at both environments had high heritability estimate indicating no influence of external environment. Moderately high heritability values found for flower length, tuber diameter, plant height and number of nod per plant at Guduru, and for plant height, leaf length, and number of brunches per plant, nod length and tuber length at Gitilo. The low heritability values were recorded for tuber diameter, leaf width, flower length and number of nod at Gitil0, and for leaf width, number of nod, tuber length, number of brunches per plant and number of stem per hill at Guduru,

Generally, higher heritability estimates(>40%) were recorded for eight characters out of thirteen at Gitilo, and for seven characters out of thirteen at Gitilo, indicating that Guduru's growing environment was more favorable for Oromo potato. According to Singh (1990), if heritability of a character is very high, say 80% or more, selection for such a character should be easy, because there would be a close correspondence between genotype and phenotype due to a relatively smaller contribution of environment to phenotype. However, for a character with low heritability, say less than 40%, selection may be considerably difficult or virtually impractical due to the masking effect of the environment on genotypic effects.

4.5 Estimates of Expected Genetic Advance

The estimated genetic advance and expected genetic advance as percent of the mean for the characters considered at Gitilo and Guduru presented in Tables 11 and 12, respectively. Expected genetic advance as percent of the mean was generally high for most characters at both locations. Among the characters, the highest genetic advance as percent of mean recorded for all except leaf width, but for others like tuber diameter, flower length, number of nod, tuber length, number of brunches per plant and number of stem per hill. For Guduru, except for leaf width and flower length all characters as tuber length , plant height, tuber diameter, flower length, number of nod, tuber length, number of brunches per plant and number of stem per hill and number of marketable tuber per hill at Gitilo. Estimates of genetic advance as percentage of mean ranged from less than 10% for leaf width to 69.7% for number of marketable tuber per hill at Gitilo, and from less than 10% for leaf width to 80% for number of tuber per heal at Guduru. Generally, leaf width at both locations, and flower length and tuber diameter at Gitilo, and number of nod at Guduru depicted genetic advance values lower than and closer to 10%. As opposed to these, tuber diameter, flower length, number of nod, tuber length, number of brunches per plant and number of stem per heal at both locations showed relatively high (> 15%) genetic advance expectations. However, plant height, number of nod, and flower length at Gitilo, and number of brunches per plant, number of nod per plant and tuber diameter at Guduru depicted, genetic advance as percentage of the mean values between 10 and 15%.

Estimated genetic advance for tuber weight per plot indicated that the appropriate environment for improving tuber yield for the genotypes grown at mid land environment in Guduru than highland environment at Gitilo. Generally, for most characters higher genetic advance as percent of mean recorded at Guduru than at Gitilo. Since tuber length , plant height, tuber diameter, flower length, number of nod per stem, tuber length, number of brunches per plant, number of stem per hill and number of marketable tuber per hill showed relatively high genetic advance as percent of mean and high heritability at both locations; hence, they can be used as a selection criterion, but ultimate evaluation must be performed in the target environment prior to using them.

Summary and Conclusion

Plectranthus edulis is an indigenous annual tuber crop grown widely in the central, southern, western, northwestern and southwestern parts of Ethiopia (Edward, 1991; Abdissa, 2000; GRIN, 2005). In different growing areas of Ethiopia, different vernacular names are used for *P. edulis*. For this experiment, 20 promising Oromo potato accessions (all in the genus *Plectranthus edulis (Coleus edulis*) belongs to the family Labiatae (Lamiaceae) was collected from Western Oromia growing farmers, and planted at two locations (Gitilo and Guduru). Tubers was used as planting material for all accessions & planting material have similar size, all with three rings with medium size. It was conducted in 2007/08 growing season of Ethiopian calendar.

The result of pooled analysis of variance shows there is highly significance difference between all genotypes ($P<0.01$). In addition, location effect was highly significant for 11 of the variables out of 13, one variable (number of stem per hill) shows none significance difference. In other case the interaction of genotype and location shows none significance for seven of the characters (plant height, leaf width, flower length, number of stem per hill, number of node per stem, inter node length), significance ($P \leq 0.05$) for two of the characters (leaf length and tuber length) and highly significance ($P \leq 0.01$) for four important characters (number of tuber per hill, tuber weight per plot, tuber diameter and number of marketable tuber per hill) out of 13 characters. In study, the PCV values were greater than GCV values across environments although the differences were small. This indicated that the environmental effect was small for the expression of most characters.

Among all characters, higher GCV and PCV values (>10%) were observed for tuber weight per plot, tuber length, number of marketable tuber per hill, number of stem per hill, number of brunches per stem and leaf length at Gitilo; at Guduru, higher GCV and PCV values were observed for flower length, tuber diameter, tuber weight per plot, tuber length, number of marketable tuber per hill, number of stem per heal, number of brunches per stem and leaf length. The high PCV and GCV observed are evident from their high variability that in turn offers good scope for selection.

The high heritability values for most of the characters could attribute to the relatively favorable environment at both locations. Heritability estimates expected to be lower in poor environments where heritability concealed due to a greater genotype by environment interaction component. Tuber weight per plot at both environments had high heritability estimate indicating no influence of external environment. Moderately high heritability values found for flower length, tuber diameter, plant height and number of nod per plant at Guduru, and for plant height, leaf length, and number of brunches per plant, nod length and tuber length at Gitilo. Among the characters, the highest genetic advance as percent of mean recorded for all except leaf width, but for others like tuber diameter, flower length, number of nod, tuber length, number of brunches per plant and number of stem per hill. For Guduru, except for leaf width and flower length all characters as tuber length , plant height, tuber diameter, flower length, number of nod, tuber length, number of brunches per plant and number of stem per hill and number of marketable tuber per hill at Gitilo. High estimates of heritability coupled with high genetic advance were also observed for these characters, indicating that they can be effectively improved through selection.

References

Abebe D (1988). Potentially valuable crop plants in a Vavilovian center of diversity, Ethiopia. In: Attere F., Zedan H., N.Q.NG and Perrino P.(ed). Crop genetic resources of Africa. Proceeding of an International Conference on Crop Genetic Resources of Africa Vol.1, Nairobi, Kenya.

Abebe Demissie.1998. Potentially valuable crop plants in a Vavilovian centre of diversity: Ethiopia. ***In***: F.Attere, H.Zedan, N.Q.NG and P.Perrino (eds), Proceedings of an International Conference on Crop Genetic Resources of Africa, Vol I, Nairobi, Kenya.

Abdissa G (2000). Root and tuber crops as complements to sustainable livelihood of the farm family in West Ethiopia. ***In***: AgriTopia, Quarterly Newsletter of EARO, Vol.15. Addis Ababa, Ethiopia. pp. 2-3.

Amsalu. T (2004). On indigenous production, genetic diversity and crop ecology of enset (Enset ventricosum (Welw) Cheesman). Ph.D.thesis, Wageningen University, The Netherlands Agricultural Publishing and Documentation, Wageningen, The Netherlands.

Bako Agricultural Research Center, 2004. Annual Research Report, 2004/2005. Bako, Ethiopia.

Burton, G.W. and E.H. Devane. 1988. Estimating heritability in Tall Fescue (Festuca arundinacea) from replicated clonal material. Agronomy Journal 45: 487-488.

Edward S (1991). Crops with wild relatives found in Ethiopia. ***In***: Engels JMM, Hawkes JG, Melaku W (ed): Plant genetic resource of Ethiopia. Cambridge. pp. 42-74.

EIAR, 2008. Root and Tuber Crops: The Untapped Resources. Ethiopia Institutes of Agricultural Research, Addis Ababa, Ethiopia, pp: 1-320.

Endale T (1997). Morphological characterization of enset (Ensete ventricosum (welw) Cheesman) clones and the association of yield with different traits. M.Sc. Thesis presented to the School of Graduate Studies, Alemaya University of Agriculture.

GRIN (Germplasm Resource Information Network)[Online database].(2005). National genetic resource program. National germplasm resource laboratory, Beltssoille, Maryland USDA, ARS.[http://www.ars-grin.gov2/cgi-bin/npgs/html/taxon.]

Institute of Agricultural Research (IAR) (1980) Progress report of the Department of Horticultural, Root and Tubers Team for the period 1978/79, Jimma, Ethiopia.

PGRC/E (Plant Genetic Resource Center/Ethiopia) (1986). Ten years of collection, conservation and utilization (1976-1986). Addis Ababa,

Reinhard F, Admasu A (1994). Honeybee flora of Ethiopia. The National Herbarium, A.A., Ethiopia.

Singh, B.D., 2003. Plant Breeding: Principles and Methods. Kalyani Publishers, New Delhi, India,pp:51-103.

Richard, R.A., A.G. Condon and G.J. Rebetzke. 2001. Traits to improve yield in dry environments. In M.P. Reynolds, J.L. Ortiz-Monasterio and A. McNab (ed.) Application of Physiology in Wheat Breeding. Mexic, D.F.: CIMMYT.

Uphof JCTH (1968). Dictionary of economic plants. Second edition.

Westphal E (1975). Agricultural systems in Ethiopia. Center for crop diversity.

Zeven AC, Zhukovsky PM (1975). Dictionary of cultivated plants and their centers of diversity. Center for Agricultural Publishing and Documentation, Wagenigen.

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