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# Diversity of Enset Landraces (*Ensete ventricosum* (Welw) Cheesman) in Aleta Chuko District, Sidama Zone, South Nation Nationality People and Regional State, Ethiopia

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**Abstract:** The objective of this study was to investigate the diversity of enset landraces in Aleta Chuko district. Accordingly, the study was conducted on the diversity of enset landraces in 125 randomly selected households at five different Kebeles (neighborhoods, the smallest administrative units in Ethiopia) in Aleta Chuko district, Southern Ethiopia. Based on the interview and field observation 55 enset landraces from sampled households as well as additional 6 enset landraces from unsampled households were recorded. There were variation in the diversity of enset landraces in the selected Kebeles of the district with altitudinal variation, the highest diversity being recorded in Lelawomerea with high altitude ( $r = 0.85$ ,  $p < 0.05$ ) and lowest in Rufowayino (low altitude) with relative dissimilarity coefficient of 74%. The result from this study showed that diversity, richness, and evenness of enset landraces varied along the study Kebeles. These variations largely depend on elevation, climate, precipitation, availability of sucker, good management and presence of organic fertilizer (animal dung).

**Keywords:** Diversity, Evenness, Landraces, Enset, Dissimilarity Coefficient and Richness

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## 1. Introduction

Enset (*Ensete ventricosum* (Welw) Cheesman) is a perennial herbaceous and monocotyledonous crop that belongs to the family *Musaceae* and fruits only once in its life cycle (after 6–10 years) depending on climate and landrace type. Enset is related to and has physical resemblance with the banana plant and as a result, it is sometimes known as a false banana [14, 19, 6]. However, Enset belongs to the family *Musaceae*, and the genus *Enset*. Banana is in the same family as enset, but it is classified in the genus *Musa*. Although enset produces banana-like fruits, these fruits are not edible [8, 16, 2]. The underground corm and the aerial pseudo stem made up of overlapping leaf sheaths are edible after some processes. Starchy food is produced by grinding the corm or scraping the pseudo stem, followed by a short fermentation period [6, 12].

Enset is the main crop of a sustainable indigenous African system that ensures food security in a country that is food deficient [1, 11]. Ethiopia is one of the centers of diversity

and origin for various agricultural crops [10]. Enset is one of the oldest cultivated plants of Ethiopia and it seems that only in Ethiopia was it domesticated. Enset represents about 65% of the total crop production in the southern region of Ethiopia. Productivity is very high compared to other crops but varies depending on edaphic factors, altitude, cultural practices and varietal differences [20, 13, 17].

Intra-species diversity of agricultural crops can be assessed employing the crop populations that farmers commonly distinguish as farmers' varieties, traditional varieties or simply landraces [4]. As landraces are morphologically distinct, farmers can identify and subsequently attach local names for them. Besides, different landraces are recognized to have characteristic adaptation to edaphic factors, reveal individual response to time of seeding, and have typical days to maturity, height, nutritive value, use, and other properties [4, 5].

The loss of diversity in the form of traditional crop varieties or landraces throughout the world has been under the subject of considerable concern in the past three decades. It could be due to landraces have been regarded as irreplaceable resources. This disappearance of landraces,

termed genetic erosion, has been described as a loss of plants with potential agricultural and economic value, and has implications for the food supply and the sustainability of both intensive as well as locally adapted traditional agricultural systems [4, 7]. Moreover, Studying the diversity of landraces is central to acquire current information on the occurrence, extent, abundance and spatial dynamics of the available diversity which is instrumental for planning and implementation of effective *in-situ* and *ex-situ* conservation strategies [21].

In Ethiopia, the Studies of less known crops diversity such as enset at local level remain very limited [18]. As a result, the extent and loss of the available diversity as well as the factors that control them in areas of centers of diversity are not clearly understood for many crops. Moreover, the status and selective significance of the individual landraces and their contribution to overall diversity are unknown [22]. Due to this it needs further studies to investigate the diversity of enset landraces in traditional farming societies which helps to maintain the existing enset landrace diversity or to exploit it in a sustainable basis.

Variety of enset landraces exist in, South Nation Nationality People and Regional State (SNNPRS) which is one of the major food crops in most part of this region. *Sidama* zone is one of 13 zones of SNNPRS known for the production of enset crop as the *Sidama* People derive their principal food from enset. *Aleta Chuko* district, which is one of 21 districts in *Sidama* zone, has tremendous potential for the cultivation of variety of enset landraces. Therefore, the general objective of this study was to investigate the diversity of enset landraces in *Aleta Chuko* district. The specific objectives of the study were, to identify the diversity of enset landraces and to determine variation in composition of enset landraces among the different study *Kebeles*.

## 2. Materials and Methods

### 2.1. Description of the Study Area

*Aleta Chuko* district is located in *Sidama* Zone, Southern Nation Nationalities people regional state (SNNPRS) within 6°27'20"E – 6°40'14"N latitude and 38°12'31"E–38°25'33"E longitude. *Aleta Chuko* district is situated 338 km south of Addis. The district consists of 28 *Kebeles* (the smallest administrative unit in Ethiopia) and has an estimated area of 32,248 hectares. The population of the study area is almost entirely of the *Sidama* ethnic group (91%). The altitude of the district ranges between 1,400 meters to 2,300 meter above sea level. The district has two agro-climatic zones, which are *Kolla* (lowland) and *Weyina Dega* (midland). A mean annual rainfall of the district is 11,001,400 mm. Agriculture is the dominant means of livelihood for the majority of *Aleta Chuko* people. The common crops in the district are *Enset ventricosum*, Coffee (*Coffea arabica*), Chat (*Catha edulis*), Avocado (*Persea americana*), Mango (*Mangifera indica*), Pineapple (*Ananas comosus*). *Enset ventricosum* is the main staple food for rural population of the study area.

### 2.2. Data Collection

A reconnaissance survey was made at the beginning of the study to select rural villages (*Kebeles*) in *Sidama* Zone, *Aleta Chuko* district. The study *Kebeles* (the smallest administrative unit in Ethiopia) were selected purposively based on their distribution, production potential of enset and altitude that were believed to affect diversity of enset landraces. The study sites range in altitude between 1500 and 2300 m.a.s.l. Based on the above selection criteria out of 28 *Kebeles*, the study was conducted only on five representative *Kebeles*. Accordingly, *Mangudo*, *Rufowayino*, *Dengorakewado*, *Gelima* and *Lelawomerera* were selected to conduct this research. From each *Kebele* 25 households were selected randomly bringing the total number of sampled households to 125. Data were collected from randomly selected informants with different socioeconomic backgrounds. The primary data was collected through semi-structured interview, group discussion and field observation. Secondary source of data was obtained from the agricultural office of the district, from different books, journal and research article.

### 2.3. Data Analysis

The collected data was analyzed by using SPSS (statistical package for social sciences). A descriptive statistical method was employed to analyze and summarize the data and to calculate percentages, means and other measures of central tendencies. Enset landraces diversity analysis (Shannon1949) including (Shannon-Wiener Index,  $H'$ ) and richness and evenness ( $E = H'/H'max$ ) of each study *Kebele* were analyzed [9]. Evenness has values between 0 and 1 where 1 indicates the condition where all landraces are equally abundant while 0 indicates that few landraces are more abundant. On the other hand, variation in landraces composition that occurred between sites was analyzed using Beta diversity index ( $\beta$ ) [3]. Beta diversity index was calculated for all pairs of *kebeles*.

In addition different households' characteristics such as age of households, size of land in hectares and altitude were correlated with landraces diversity by using Pearson correlation coefficient. The value of Pearson correlation coefficient ( $r$ ) lies between -1 and + 1. A value of the correlation coefficient close to + 1 indicates a strong positive linear relationship (i. e. one variables increases with other). A value close to -1 a strong negative linear relationship [23].

## 3. Results and Discussions

### 3.1. Households Characteristics

Table 1 presents the household characteristics of the sampled study *Kebeles* (neighborhoods, the smallest administrative units in Ethiopia). From the total respondents, 20.8% of the household's heads had age between 20–35 years old, while a little below half of the household heads (42.4%) had age between 36–50 years old, 28% and 8.8% of the

households heads had age between 51–75 and above 75 years old respectively. Most of the respondents were males (83.2%) and only a few of them were females (16.8%).

Assessment in the size of the land that the respondents possessed indicated that the majority (68%) of the respondents had 1–2 hectares, where as 26.4% had less than two hectares and only 5.6% of the respondents had more than two hectares. The maximum size of land possessed by the household was three hectares while the minimum was half hectares. The sizes of enset farm are generally small and on average farmers cultivated about 1.1 hectares/farms. The size of land is one of the factors that control the diversity of enset landraces. As the size of land increase, the diversity of enset landraces could also be increase. From the total households 9.6% of them had 16-30 landraces, majority of the households (63.2%) had 5–10 landraces and 20% and 7.2% of the households had 11–15 and less than 5 landraces respectively.

**Table 1.** Households Characteristic.

Characteristics	Number of households	Percentage of households (%)
I. Age		
20–35	26	20.8
36–50	53	42.4
51–75	35	28
Above 75	11	8.8
II. Sex		
Males	104	83.2
Females	21	16.8
III. Educational status(grade)		
Uneducated	7	5.6
1–4	66	52.8
5–8	36	28.8
9–10	11	8.8
≥ 11	5	4
IV. Size of land in hectares		
1–2	85	68
>2	7	5.6
<2	33	26.4
V. Number of landraces		
16–30	12	9.6
11–15	25	20
5–10	79	63.2
Below 5	9	7.2

### 3.2. Richness, Diversity and Evenness of Enset Landraces

Based on observation made during the study *Ensete ventricosum* is cultivated at the backyard of the home followed by *Coffea arabica* and *Chata edulis* in *Aleta Chuko* district. At species level *Ensete ventricosum* is found at greatest frequency with different varieties. *Aleta Chuko* district has varieties of enset landraces. There are different characteristics that farmers used to identify these landraces in the study area. Some of these are color (of pseudo stem, midrib, leaf and petiole), maturity, disease response, yield, leaf dimensions (width and length), and pseudo stem (length, orientation, size and girth). Similar study conducted on Sidama folk identification, naming, and classification of cultivated enset varieties [5] reported different characters

such as morphological, physiological, chemical and vegetative cycle used by farmers in the identification of enset varieties which are almost similar in the current study.

Based on the interview, 55 enset landraces from sampled households were recorded. In addition to the 55 enset landraces, six (6) other landraces were found in farms of unsampled households. These were *Aleti-Genticha*, *Boowete-uuwisho*, *Mikichcho*, *Tuba*, *Chinnako* and *Dukichee-ado*. In a similar study conducted on enset landraces of Bonga, Ethiopia, [22] reported a total of 65 locally known enset landraces. Moreover, [4] studied enset landraces in Sidama, Ethiopia, and they found 79 locally recognized enset landraces besides the additional landraces which were known to exist in other households not included in their samples. Apart from a regional variation among farmers in their knowledge to distinguish enset landraces, Characters associated with growth and adaptation [19, 8] climatic variations, availability of germplasm or cultural history and the degree of dependency on enset as a food source [8] could account for variations in a number of enset landraces found in the present study and the same reported from previous studies [4, 8, 22].

The number of enset landraces (richness) at the households' level varied between 4 and 30. Figure 1 revealed the relationship between sample size and number of landraces per sampled *Kebeles* in each household. From Figure 1 the lowest and highest number of landraces in each *Kebele* at the household level was 4 and 13, 4 and 10, 5 and 18, 6 and 21 and 4 and 30 in *Mangudo*, *Rufowayino*, *Gelma*, *Dengorakewado* and *Lelawomerera* respectively. The highest variation between the lowest and highest number of landraces at the household level was recorded at *Lelawomerera* (4 and 30) while the lowest variation was recorded in *Mangudo* (4 and 10). The mean value of the landraces of the whole households was 9.2 while the standard deviation was 4. This variation in the number of landraces could be due to size of land that the household possessed, age of household head and availability of sucker in the market or in the neighbor.

Generally the number of landraces recorded per households was somewhat comparable except from a few households. For example in *Lelawomerera* (with the highest number of landraces), for the documentation of 90% of the total landraces only 12 households were needed. This could be due to exchange of sucker between the neighboring households. In similar study conducted on enset landraces diversity in East Africa High land, [15] reported enset seedlings have various ways of exchange with neighbors or relatives and trade for long distance. This leads to the similarity of cultivated enset landraces between point's distances from each other which are similar to the current study. The total number (richness) at *Kebeles* level as well as number of enset landraces at household level in *Lelawomerera* was the highest of all. It could be due to the altitude of this *Kebele* which is the highest when compared with the other sampled *Kebeles*.

As the data in Figure 2 portrays, the number of enset landraces recorded generally increased with the

corresponding increase in the number of households. Notwithstanding this, there were certain dips representing a decreasing pattern, particularly between 40 and 50 households. On the other hand, there is an increasing trend up to 117 households. This variation in number of landraces at the household level could be due to size of land that the individual household possessed, variation in the management of enset garden, differences in the availability sucker and age of households heads (related to knowledge about landraces).

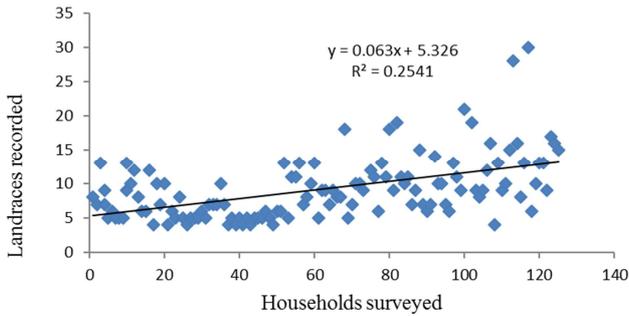
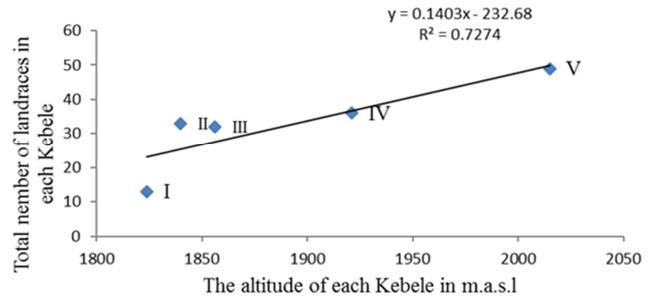


Figure 1. Relationship between sample sizes and number of landraces ( $R^2 = 0.254$ ,  $p < 0.01$ ).

Moreover, there was variation in the diversity of enset landraces across each sampled Kebele. The number of enset landraces in each sampled Kebeles was varied between 13 (*Rufowayino*) and 49 (*Lelawomerera*). The number of enset landraces in the remaining Kebeles was 32, 33 and 36 in *Mangudo*, *Dengorakewado* and *Gelma* respectively (Table 3). The lowest number of landraces was recorded at *Rufowayino* (13) while the highest in *Lelawomerera* (49) (Table 3) with mean and standard deviation of 32.6 and 12.9 respectively. The number of landraces in *Mangudo* and *Dengorakewado* was almost similar (Table 3). The possible reason for this could be due to small altitudinal variation and climatic factors such as temperature, rainfall, humidity may be similar. On the other hand there existed great variation in number of landraces between *Lelawomerera* and *Rufowayino* (Table 3). The reason for this could be altitudes of the two Kebeles were varying greatly than the other Kebeles (Figure 2). The differences in landrace diversity between each Kebele were directly related to altitude (Figure 2). This means as altitude increases, the number of enset landrace also increases. There existed significant ( $p < 0.05$ ) and strong positive linear relationship ( $r = 0.85$ ) between the diversity of enset landraces and altitude (Figure 2).

Furthermore, Richness, Shannon and Simpson diversity indices were lower at low altitudes, but reached maximum (49) at 2015 m.a.s.l (*Lelawomerera*) (Figure 2) and decreased slightly as the altitude decreased. Accordingly, at *Lelawomerera* the highest number of landraces were recorded which accounted for more than 89% of all the landraces found in the study district followed by *Gelma* and *Dengorakewado*. Similar study conducted on diversity of enset landraces in Sidama zone, [4] reported that the number of landraces was lower at lower altitudes while reached maximum at highest altitude (2400m.a.s.l) which is also similar to the current study.



Caution: I-Rufowayino, II-Dengorakewado, III-Mangudo, IV-Gelma, V-Lelawomerera.

Figure 2. Relationship between altitude and number of Landraces in each Kebele ( $R^2 = 0.727$ ,  $p < 0.05$ ).

Table 2 summarized the calculated values of landraces Richness, Evenness, Simpson Index (1949), Shannon and Weaver (1949) diversity index for the five Kebeles. A high diversity index (at *Lelawomerera*) suggests that the area is not dominated by one or two landraces rather by a number of successful landraces which result a more stable enset ecosystem (Table 3). Moreover, the Shannon, Simpson and Evenness diversity index for *Dengorakewado*, *Mangudo* and *Gelma* was more or less comparable. This could be due to the altitude of those Kebeles is also more or less comparable each other. On the other hand at *Rufowayino* except the evenness index, the remaining diversity indices were low (Table 2). A low value for the index diversity (at *Rufowayino*), suggesting only a few successful landraces, or it indicates that the Kebele is dominated by a limited number of landraces. It could be the result of a hostile environment with only a few landraces being really well adapted to that environment.

Table 2. Landrace diversity in Aleta Chuko district, expressed as Richness (C), Evenness (E), Simpson (D) and Shannon (H') diversity indices.

Kebeles	C	H'	E	D	Unique	%
I	13	2.12	0.64	7.32	0	23.6
II	33	3.0	0.63	17.7	1	60
III	32	2.75	0.49	12.3	1	58.2
IV	36	2.96	0.54	19.58	0	65.5
V	49	3.55	0.71	27.7	6	89

Caution: I-Rufowayino, II-Dengorakewado, III-Mangudo, IV-Gelma, V-Lelawomerera

As to the percentage of enset landraces, from the total enset landraces (55) recorded in selected Kebeles, 89% landraces were recorded in *Lelawomereera*, 65.5% in *Gelma*, 60% in *Dengorakewado*, 58.2% in *Mangudo* and 23.6% in *Rufowayino* (Table 2). The percentage of enset landraces in *Lelawomerera* was highest because of its highest altitude from the study Kebeles. However, the lowest percentage of enset landraces was recorded in *Rufowayino*, it could be due to the lowest altitude of *Rufowayino*. Moreover, the total number of unique landraces was 8. From 8 unique landraces 6 of them were recorded in *Lelawomerera*.

Similarly, landraces evenness was highest for farms in *Lelawomerera* (Table 2). In this Kebele the values of

Evenness (E) as well as Shannon's diversity index were the highest. The Evenness value of this Kebele is 0.71 (Table 2). This value of evenness indicated that 71% of the landraces were under uniform or even distribution. Moreover, the high value of the evenness index at *Rufowayino* (0.64) next to *Lelawomerera* suggests (Table 2) that the limited number of landraces at *Rufowayino* was evenly distributed. On the other hand the least evenness value of 0.49 was calculated for households in *Mangudo* with least uniform allocation of enset landraces which indicates that only 49% of the landraces were under uniform or even distribution. The Mean and standard deviation of the evenness value of the whole landraces was 0.6 and 0.087 respectively. On the whole, the population of enset landraces had a relative evenness of 60% in the sampled study Kebeles.

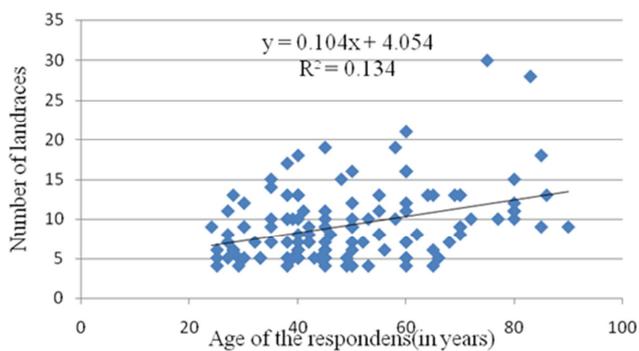


Figure 3. Relationship between ages of households and number of landraces ( $R^2 = 0.134$ ,  $p < 0.01$ ).

The relationship between the age of households head and number of landraces is presented in Figure 3. Figure 3

revealed that as age of the households head increases, the number of landraces also increases. There was highly significant ( $p = 0.01$ ) positive association ( $r = 0.37$ ) between the age of the households and number of landraces (Figure 3). This could be due to as age of the households increase, their knowledge to distinguish enset landraces also increase which intern might help to increase the diversity of enset landraces.

On the other hand, the relationship between sizes of land in hectares and number of landraces is presented in Figure 4. Figure 4 revealed that as size of land increases, the number of landraces also increases. There was highly significant ( $p = 0.01$ ) positive association ( $r = 0.77$ ) between the size of land in hectares and number of landraces. Since this correlation coefficient ( $r = 0.77$ ) is close to +1, it indicates that a strong positive linear relationship between size of land in hectares and number of landraces. This could be due to as the size of land increase, the chance of cultivating large numbers of landraces also increase.

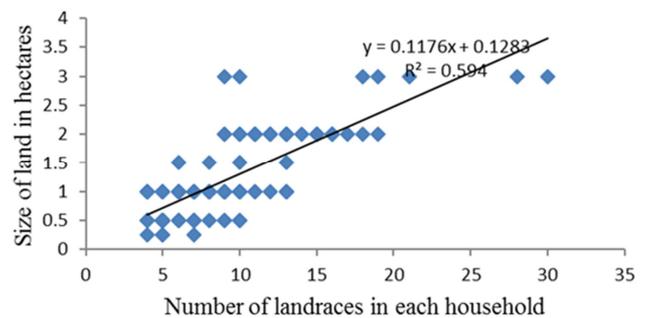


Figure 4. Relationship between size of land in hectares and number of landrace ( $R^2 = 0.594$ ,  $p < 0.01$ ).

Table 3. The total number of each Enset landrace at Kebeles and households level in Aleta Chuko district.

No	LANDRACES	KEBELES					Total number of Farms/Households	Total number of Sites/Kebeles
		I	II	III	IV	V		
1	Adami	-	-	1	-	3	4	2
2	Adami-ado	-	-	1	1	-	2	2
3	Ado	25	25	25	25	25	125	5
4	Agenna	-	2	1	-	9	12	3
5	Aletichcho	-	7	1	4	5	17	4
6	Ambooma	-	7	4	2	4	17	4
7	Arrishsho	-	-	1	1	6	8	3
8	Asikala/Asitara	2	4	8	10	16	40	5
9	Ayidara	-	-	1	1	2	4	3
10	Birbo	-	5	-	-	4	9	2
11	Birra	3	16	7	15	11	52	5
12	Biru-damala	-	1	-	-	-	1	1
13	Borbodhichcho	-	9	-	2	2	13	3
14	Boowe	-	-	1	-	-	1	1
15	Boowete-ado	-	11	1	-	-	12	2
16	Bullo	-	1	-	1	3	5	3
17	Chacho	2	9	2	9	10	32	5
18	Damalaa	-	1	1	-	3	5	3
19	Dansite	-	1	-	-	1	2	2
20	Dongichcho	-	-	-	-	1	1	1
21	Doowiraamo	-	1	1	1	4	7	4
22	Duwanchcho	-	-	-	-	2	2	1

No	LANDRACES	KEBELES					Total number of Farms/Households	Total number of Sites/Kebeles
		I	II	III	IV	V		
23	Gedimee	1	3	2	4	3	13	5
24	Gediwochcho	21	21	19	21	23	105	5
25	Gedio-ado	1	6	1	7	5	20	5
26	Geemechella	-	2	-	-	1	3	2
27	Geena	6	17	18	9	5	55	5
28	Gentichcho	25	25	25	25	25	125	5
29	Godare	-	-	-	1	2	3	2
30	Gooloma	-	-	-	3	4	7	2
31	Gorichcho	-	-	-	-	5	5	1
32	Gosaloo	-	4	-	3	5	12	3
33	Gulumo	7	21	11	18	11	68	5
34	Haaho	-	2	1	2	6	11	4
35	Hansha	-	-	-	-	3	3	1
36	Hayisa	-	-	-	-	1	1	1
37	Heekeche	-	3	1	1	7	12	4
38	Kanda	-	-	1	1	5	7	3
39	Keeshe	-	-	-	1	4	5	2
40	Kinchcho	-	-	1	-	6	7	2
41	Kirre	-	-	-	1	4	5	2
42	Kitichcho	17	16	12	17	5	67	5
43	Kuule	-	-	1	1	4	6	3
44	Leemichcho	-	1	-	2	7	10	3
45	Maade	-	-	1	1	3	5	3
46	Midashsho	21	25	21	24	25	116	5
47	Mundraro	-	1	-	-	3	4	2
48	Sindaancho-ado	-	-	-	1	1	2	2
49	Siricho	-	2	2	2	-	6	3
50	Siriro	-	3	-	-	4	7	2
51	Toroora	-	-	-	1	4	5	2
52	Tunnako	-	8	-	3	2	13	3
53	Uuwishsho	2	3	9	9	12	35	5
54	Waanikoore	-	-	1	-	7	8	2
55	Woodaro	-	-	-	-	1	1	1

Caution: I-Rufowayino, II-Dengorakewado, III-Mangudo, IV-Gelma, V-Lelawomerera.

### 3.3. Extent of Variation in Composition of Enset Landraces Among the Different Study Kebeles

Table 4. Beta diversity index ( $\beta$ ) (dissimilarity values for enset landraces Composition of the Kebeles).

Kebeles	II	III	IV	V
I.	0.61	0.59	0.64	0.74
II.		0.49	0.47	0.42
III.			0.38	0.44
IV.				0.33

Note: I- Rufowayino, II- Dengorakewado, III- Mangudo, IV- Gelma, V- Lelawomerera.

Table 4 revealed that the variation in the composition of Enset landraces between pairs of locations ranged between 0.33 and 0.74 with a mean and standard deviation of 0.51 and 0.127, respectively. The highest calculated value of Beta diversity index was 0.74, the extent of variation between *Rufowayino* (I) and *Lelawomerera* (V) was the greatest of all from other pairs of *Kebeles* (Table 4). They shared only 26% of the landraces and 74% were dissimilar. The reason for this could be the temperature, altitude, rain fall etc of the two

*Kebele* (*Lelawomerera* and *Rufowayino*) vary greatly. The extent of variation was lowest between *Gelma* (IV) and *Lelawomerera* (V) with Beta diversity index of 0.33. As Beta diversity index approached to zero, sites being the same. There were a few variations in the landraces composition in *Gelma* and *Lelawomerera*; it could be due to low altitudinal variation. On the whole, the population of enset landraces had a relative dissimilarity of 51%. The value of Beta diversity index varies between zero and one. As Beta diversity index approached to one, the diversity became higher and being completely different at value one [3].

## 4. Conclusions

This study presented the diversity enset landraces in *Aleta Chuko* district. A number of conclusions can be drawn based on the findings of the study. Based on interview and field observation, the result from this study showed that there were a total of 55 named enset landraces from 125 households that were selected from the five *Kebeles* in the study area. An average of 9.2 enset landraces was grown in each farm. The

result from this study also showed that richness, diversity and Evenness of enset landraces were different across *Kebeles*. Variation in the composition of enset landraces among the different peasant associations (PAS) was determined by computing Beta diversity index. This existence of different (variety) of enset landraces largely depend on elevation, climate, availability of sucker, good management and presence of Organic fertilizer (animal dung). Finally, the occurrence of cash crops such as *Coffea arabica* and *Catha edulis*, land scarcities, diseases such as the bacterial wilt, population increase, lack of good management and wealthy status of farmers, also directly or indirectly minimize the diversity of enset landraces in the study area.

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