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RESEARCH ARTICLE

# Farmers' local knowledge on classification, utilization, and on-farm management of enset (*Ensete ventricosum* [Welw.] Cheesman) landraces diversity in Hadiya, southern Ethiopia

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**Abstract** Enset (*Ensete ventricosum* [Welw.] Cheesman) is a multipurpose perennial crop widely grown and consumed in Ethiopia. Although it is a high-value crop for local farmers, essential information on indigenous knowledge of its farming system, cultural practices, and traditional utilization is still an under-researched domain. This study was designed to assess and record the wealth of indigenous knowledge on enset, covering the local identification, categorization, and nomenclatural system in tandem with traditional uses of the enset crop. A random sample of 240 enset farmers from seven districts and 12 subdistricts of the Hadiya Zone were interviewed, along with four to six key informants selected from each subdistrict. Direct on-farm observation, 12 focus group discussions, and secondary data were considered in the documentation of indigenous and local knowledge associated with the enset farming system and use culture. We identified with the farmers 99 local farmer-named enset landraces under cultivation. Farmers identify and categorize enset landraces informally using morphological features as the main criterion. The local names of some landraces indicate their uniqueness in morphological traits, place of origin, agronomic features, and quality attributes of their products. Based on farmers' perception, cultivated enset landraces are grouped into 'soft' (*qechalwesa*) and 'hardy' (*qoxalwesa),* considering characteristics regarding the strength of harvesting and processing, rate of fermentation, and quality of the end products. The indigenous knowledge about the cultural, social, and economic values of enset and its production system practiced by local farmers is crucial for the availability of the present landrace diversity. To sustainably use and conserve enset genetic resources, it is necessary to integrate indigenous knowledge with modern formal science, including in a field gene bank in Hadiya and other key enset growing areas in Ethiopia as a climate-smart crop.

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## Introduction

Traditional crops are those grown by local farmers over a long period and that are well adapted to their local conditions and also well suited to local socio-cultural needs (Villa et al. 2005; Ulian et al. 2020). Farmers have a wealth of indigenous knowledge on crop production in their communities acquired through accumulation of experience and informal experiments that could be useful for a robust crop breeding program, improving grain quality and storage equipment, designing weed and pest control strategies, organic seed conservation, food preparation, and environmental conservation (Tella 2007). On-farm conservation involves farmers' continued cultivation and management of a diverse set of crop populations and accompanied taxa in the agro-ecosystem where the crop evolved, or in secondary centers of diversity (Alvarez et al. 2007), where the landraces attained their characteristic features.

According to Vavilov (1951), the Ethiopian highlands are both the center of origin and diversity for many crops, including enset. Enset is believed to have been domesticated in Ethiopia by ancient people who migrated out of the lowlands and grasslands due to an extended dry period and settled in the highlands of southwestern Ethiopia and found enset that they probably started consuming and eventually cultivating (Brandt 1996). Enset [*Ensete ventricosum* (Welw.) Cheesman] is a monocarpic, tree-sized perennial herb that belongs to the order Zingiberales and the family Musaceae. The latter family is subdivided into the genera *Musa* and *Ensete* (Simmonds 1966). The wild form of *E. ventricosum* is common and widespread in tropical Africa, from Ethiopia to Kenya and Uganda, south to Mozambique, and west to the Democratic Republic of the Congo and Cameroon (Simmonds 1958). *E. ventricosum* grows within altitude ranges of 1500–3100 m above sea level, but scattered plants can also be found at lower altitudes (Abebe 2005), and some scattered cultivation exists at higher altitudes (3350 m). For optimum growth, the plant requires an average rainfall of 1100–1500 mm per year and a mean temperature of 16–20 °C. Enset grows well in drained and fertile soil types (Bezuneh and Feleke 1966), and it takes 8–16 years to reach full maturity (Shank and Ertiro 1996), depending on environmental conditions, management practices, and varietal types.

*E. ventricosum* is an important crop contributing to food security and rural livelihoods for about 1/4 of the people of Ethiopia, distributed in the densely populated southern and southwestern parts of Ethiopia (Brandt et al. 1997; Borrell et al. 2020). The enset-based farming system, which is characterized by the cultivation of enset as the main staple or as a co-staple with other crops, is an indigenous and sustainable agricultural system in Ethiopia (Westphal 1975), and it is practiced by over 45 ethnic groups for food and other household needs (Brandt et al. 1997; Negash 2001; Asfaw 2018). It also guarantees food security and stability for the household economy because processed products can be stored for a long time. In addition, the live plant can be maintained on-farm and harvested any time when the need arises (Negash 2001; Borrell et al. 2020). Farmers in enset-growing areas are often heard affirming that "enset is the enemy of hunger, both human and livestock life is impossible without it" (Tsegaye 2002).

The primary food products obtained from enset are *qocho*, *bulla*, and *amicho*. *Qocho* is fermented starch obtained from scraped pseudostems and pulverized corms. *Bulla* is another enset product prepared by squeezing out the liquid containing starch from scraped pseudostem and pulverized corm and allowing the resultant starch to concentrate into a white powder. *Amicho* is an inner, fresh corm used as cooked potato-like product of enset corm. This product is mainly obtained from relatively younger enset plants that are prepared and consumed in a similar way to other root and tuber crops (Brandt et al. 1997).

The social values of enset to the people in the southern and southwestern parts of the country not only depend on its being the source of human food and cash income but also consider it part of their cultural heritage and symbol, and it is a unifying crop for the highland areas of the southern parts of the country (Shigeta 1990; Alemu and Sanford 1996). Moreover, enset has ecologically important functions in producing organic matter, creating a nutrient reservoir in the soil, controlling erosion, and contributing to the stability and continuation of the farming system (Woldetensaye 1997). Enset plant architecture

makes it suitable for rainwater harvesting and storage. Furthermore, the fibrous roots of enset plants form a mat-like structure holding the soil intact, which, on decay, improves the soil. This water harvesting capacity in enset enables farmers to intercrop it with various crops (Kanshie 2002), but this is mostly the case in the early stage of the crop, as observed in the field as the later stages fill up the spaces when the plants expand and produce larger leaves.

The ethnobotanical naming system (sometimes called folkloric nomenclature) involves people giving names to plants based on their viewpoints. The people create these names in their willingness to distinguish the different types of plants from one another and to be precise in their verbal communication (Nedelcheva and Dogan 2009). Indigenous (traditional) biodiversity knowledge has its roots in the local names of plants and animals. Since ethnobotanical systems of naming and classification are constantly transmitted from generation to generation and recreated by communities and groups in response to their environment (Khasbagan and Soyolt 2008). Birmeta (2004) identified numerous local farmers' cultivars of enset from major growing regions and also observed genetic diversity in cultivated enset in a particular area, which appears to be related to the extent of enset cultivation, the culture, and the settlement patterns of the different ethnic groups. Farmers can clearly distinguish their cultivars based on agromorphological traits, phenological attributes, post-harvest characteristics, and different adaptive performances under abiotic and biotic stresses (Brush and Meng 1998; Loko et al. 2018). Moreover, they have names for them, and different landraces are understood to differ in their adaptation to soil type, time of seeding, date of maturity, plant height, nutritive value, use, and other properties (Sthapit et al. 1996).

Local farmers grow enset plants for several merits, which are mainly attributed to the food, socioeconomic, and cultural benefits. Although enset is a vital crop of high value for local farmers, necessary information on indigenous and local knowledge of its classification, management, and traditional utilization practices in different parts of the country is insufficiently documented and reported. Various authors (Tesfaye 2008; Maryo et al. 2014; Olango et al. 2014) reported that the distribution of some indigenous crops (e.g., enset) at the local level in Ethiopia remains limited to the traditional areas of cultivation, though enset has gone into an expansion phase in its recent history. Previous research in Hadiya enset farming systems emphasized only the recording of cultivating and management practices as well as a listing of landrace names from the limited districts (Tsegaye and Struik 2002; Yemataw et al. 2016). The attributes of enset are still insufficiently known and not fully investigated by researchers and the scientific community. While enset is a crop that has lived with the Hadiya people for millennia with rich cultivation and use history and the accumulation of time-honored ethnobotanical knowledge. The limited prior research focused on agronomy and the listing of landraces, while our study applied state-of-the-art ethnobotanical methods and showed the depth of the ethnobotanical knowledge of the Hadiya people, which is critical for improving enset research and for the development of enset genetic resources conservation strategies and sustainable uses of them.

Therefore, the objectives of this study were designed to search for and document the wealth of indigenous and local knowledge of enset cultivation, the local landrace taxonomic system (identification, naming, categorization, or classification), and traditional use and management of the species and its landraces. A related objective is to investigate and generate reliable data focused on farmers' enset-related ethnobotanical lore and the traditional practices relevant to the maintenance of on-farm enset landrace diversity in the Hadiya Zone of southern Ethiopia.

## Materials and methods

### Description of the study area

The study was conducted in the Hadiya Zone of southern Ethiopia, located between 7° 07'–7°92' N and 37°29'–38°13' E. This zone topographically lies within an elevation ranging from 501 to 3100 m above sea level, and its administrative center is Hossana town, located 232 km southwest of Addis Ababa, the capital city of Ethiopia. The zone is bordered on the south by the Kembata-Tembaro Zone, on the southwest by the Dawro Zone, on the west by the Omo River, which separates it from Oromia Region and the Yem special *Woreda (*special district*)*, on the north by the Gurage Zone, on the northeast by the Silte Zone, and on the east by the Alaba Zone; the *woredas*

of Siraro, Mirab, and Misraq Badawacho form an exclave separated from the rest of the zone and bordered in the north by Kembata-Tembaro, in the south by Wolaita, and in the southeast by Oromia Region (Fig. 1). Based on the simplified agroclimatic classification of Ethiopia (MOA 2000), the zone has three agroecological zones, namely *Kola, or* semi-desert (lowland < 1500 m), covering about 12.9% of the land area; *Woina Dega,* or cool semi-arid (mid-altitude 1500–2500 m), about 69.1%; and *Dega,* or cool and humid (highland > 2500 m), about 18%. Most of the area lies within the mid-altitude zone. For administrative purposes, the zone is divided into 13 districts, or *woredas,* which are further divided and organized into *kebeles* (subdistricts). Inhabitants (Dwellers) of the Hadiya Zone are mainly the Hadiya communities speaking the Cushitic language group, Hadiyyisa. For the midland and highland inhabitants of the Hadiya, enset cultivation and utilization make the main cropping system a pillar of the farming system in the area. Enset is the key food security and livelihood crop for the humans and domestic animals of the study area.

## Study site selection

The study was conducted in seven *woredas* or districts (Misha, Lemmo, Anlemmo, Dunna, Sorro, Gibe, and Mirab-bedawacho) in the Hadiya Zone, southern Ethiopia (Table 1). The sites were selected based on the potential and importance of enset cultivation, diversity, and distribution, as determined by the information obtained from the Agriculture offices of the zone and districts. Hadiya Zone is one of the major enset-growing areas in the country. Hence, the crop is the main food security and livelihood source, especially for the mid and highland inhabitants. Therefore, the study sites range in altitude from 1858 m.a.s.l. (Halelicho-Bero) to 2918 m.a.s.l. (Tulla) subdistrict (*kebele),* which cover nearly the entire ecological range of enset in the Hadiya Zone (Table 1). Since the

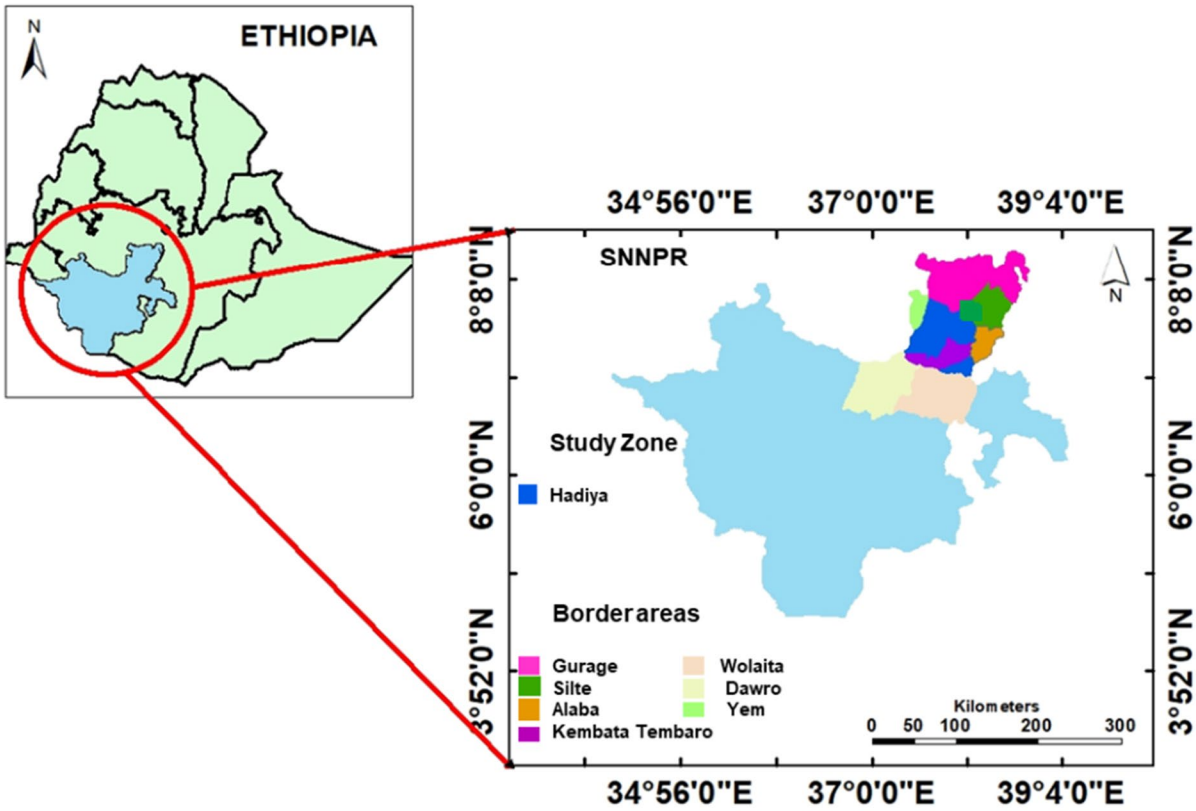


**Fig. 1** Map of the Southern Nations Nationalities and Peoples' Region (SNNPR) in Ethiopia (left) and location of the Hadiya Zone with the zones bordering it (right)

**Table 1** Sampled *woredas*, *kebeles*, elevation range, and number of households interviewed

| Administrative *Woredas* | Administrative *Kebeles* | Altitude (m) | No of households |
|---|---|---|---|
| Misha | Dangawora-Sagamo | 2465–2784 | 20 |
| | Shiro | 2547–2730 | 20 |
| | Tulla | 2520–2918 | 20 |
| Lemmo | Dijo-Demala | 2245–2418 | 20 |
| | Shurmo-Dacho | 2218–2349 | 20 |
| An-Lemmo | Bendelicho | 2115–2263 | 20 |
| | Layign-Fonko | 2241–2485 | 20 |
| Dunna | Qenqicho | 2430–2568 | 20 |
| | Somicho | 2455–2676 | 20 |
| Sorro | Qosha | 2210–2402 | 20 |
| Gibe | Halelicho-Bero | 1858–2017 | 20 |
| Mirab-Bedewacho | Danama | 1875–1930 | 20 |
| Total | | 240 | |

local people of the selected study sites have managed and used enset, they also have adequate information about enset ethnobotanical lore encoded in its farming system, genetic resources, and uses.

## Sampling

A combination of purposeful and random sampling techniques were employed for the selection of sample *woredas* from the Hadiya Zone since enset is primarily cultivated in the midland and highland zones of the study area. Of the twelve *kebeles*, five *kebeles* from the highland and seven *kebeles* from the midland found in the seven *woredas* of the zone were selected based on consultation with agricultural officers of the Hadiya Zone and the respective *woredas*. A total of 240 households (20 from each *kebele*) were selected randomly (Table 1). Among these, 143 (59.58%) men and 97 (40.42%) women participated in the individual interviews, with an average age of 47 years (lowest 33 years; highest 91 years). Four to six key informants were also chosen based on prior information obtained from agricultural extension workers, elders, and local leaders in each *kebele*.

## Ethical consideration

According to the existing national guidelines, Addis Ababa University granted permission for this study, and then, the Hadiya Zone agricultural office wrote supporting letters to notify their respective districts' administrative offices about the objectives of the study. Once all local administrative members and leaders had given their approval, interviews and discussions were held with each informant after obtaining their verbal informed consent to collect pertinent information on local knowledge (a non-clinical sample study) of the enset crops.

## Data collection

A combination of data collection methods was applied to synthesize the diverse features and collect indigenous and local knowledge associated with the enset plant in this study. Primary data collection was employed with the help of individual interviews, direct on-farm observation, key informant interviews, and focus group discussions. Before the actual study, a preliminary observation was arranged to pre-test the semi-structured interview questions to obtain a better understanding of the study area, the people, their culture and traditions, and the farming systems with three elder enset-grower farmers per district (*woreda*). The in-depth individual interview was conducted by the investigator and agricultural extension workers in the local language, Hadiyyisa, using a pre-prepared semi-structured interview schedule with simultaneous translation from the pre-printed English version (Appendix 1). In some cases, farmers tended to be reserved and unwilling to share information

with strangers in their homegardens. However, the principal investigator is already familiar with and has exposure to some of the study districts, as well as the local language, which made our task easier and communication simpler. The agricultural extension agents who collaborated with the principal investigator were well known to the informants since they were working closely with the farmers in each farming activity. The interview questions and free-listing methods (Quinlan 2005; Albuquerque et al. 2014) commonly employed in ethnobotanical research assisted in generating detailed and specific information on the enset farming system by specifically assessing farmers' views of landrace diversity, local naming, and classification, the meaning of names, traditional utilization approaches, cultural practices of cultivation, and the management system in the center of diversity. To obtain the detailed local knowledge of farmers in the study area, four to six key informant interviews were conducted with individuals who were selected for having good knowledge of the enset crop, culture, cultivation system, characteristics of landraces, and other related topics. Focus group discussions (one per kebele, each with six discussants) were also carried out to examine farmers' indigenous knowledge in joint or group interview sessions. Several issues were taken up for discussion, such as perceptions, farmers' identification and classification criteria of landraces, landrace names and naming systems, socio-economic values, cultural events, and so forth, and their insights regarding the contribution of enset agriculture to the local community. These techniques greatly facilitated gaining sufficient information in line with the objectives of implementing this study. Secondary data were also checked to generate information that provided the background context of the enset farming system and cultural links to the farming communities of Hadiya from different published and unpublished sources and reports. Furthermore, on-farm characterizations of landraces were recorded carefully for the identification of each enset landrace at maturity after examining it with individual farmers and key informants.

### Data analysis

After recurrent discussions with key informants and knowledgeable senior farmers, we verified some variations and also validated basic information collected from individual interviews. The names of all listed enset landraces were also cross-checked for minor dialect (known as cognates in ethnobotany) variations after arranging in the group for known synonyms throughout the study *woredas*. The collected data were analyzed by applying descriptive statistics such as frequencies, percentages, and averages using Microsoft Excel 2010 and SPSS Version 24. Landrace richness was calculated as the total number of individual enset of each landrace per farm named by all farmers dwelling in the studied administrative zone. Frequency was estimated as the number of individuals of a landrace with respect to the total number of landraces composing the enset farm.

## Results

### Status of enset cultivation and people attitudes in Hadiya

The cultivation of enset is closely associated with the daily lives of the Hadiya farmers, primarily in midland and highland areas. In the study area, farmers indicated that enset is a multipurpose crop available all year round, and throughout the various growth stages; the leaves and pseudostem in fresh and dried form, as well as corms, are used for several purposes. Thus, every farming household cultivates, manages, and utilizes diverse enset landraces. Farmers revealed that enset is the most important crop for livelihoods and food security in the major growing areas of the zone. Therefore, enset has been chosen as a classic multi-use crop since, except for its biological roots, the whole part is used for diverse purposes such as food, feed, traditional medicine, construction material, cultural values, and ornamental uses.

During our discussion, many farmers have observed clearly that most annual crops are severely disrupted by changing weather conditions such as prolonged drought, too little or heavy rain, and frost. This results in recurrent crop failures, leading to poor yields and food insecurity. However, different enset landraces can survive such unpredictable and harsh climatic situations. Therefore, farmers generally approve that enset is a food and feed security crop that cannot be substituted by other crops for the enset farming communities in the studied area.

## The extent of on-farm diversity and richness of enset

Hadiya farmers cultivate and maintain an impressive level of enset diversity in their homegardens. In this study, 99 vernacular names of enset landraces growing on farmers' fields were documented (Table 2). Based on the farmers' report and field observation, the number of enset landraces recorded per household ranged from 3 to 35. About half of the farmers (50.41%) cultivated 7–12 enset landraces, followed by 24.16% who cultivated 13–18; 17.5% of the farmers cultivated less than seven landraces, and only 3.3% cultivated 25–35 enset landraces per homegarden. The cultivation ranges of enset landraces maintained by farmers in the study area were expressed in percentages in Fig. 2.

In the present study, there was a remarkable variation among the enset landraces concerning their distribution. Of the recorded enset landraces, 21% were most frequently mentioned by local farmers and belonged to widely distributed enset types. According to farmers, these were multi-use types. The 15% were the least mentioned and unique types of enset landraces, rarely recorded at a few farmers' homegardens in the studied *kebeles* (Table 2).

During the discussions and interviews with farmers, it was also found that the local people in the study area cultivated different enset landraces based on several selection criteria, such as end-product quality and quantity, fermentation and maturity rate, medicinal values, disease resistance, and drought tolerance, and that they often mixed landraces with these attributes in each garden.

## Farmers' traditional categorization of enset landrace

In Hadiya Zone, farmers regularly identify and classify numerous enset landraces based on different criteria. Some of the criteria that farmers frequently use to distinguish one enset type from others are: color of pseudostem, petiole, and midrib; size (width and length); angle of leaf orientation; various end uses; disease and drought tolerance characteristics. Generally, the local farmers follow three main traditional categorization steps in authenticating their enset landraces now under cultivation. First, they identify

**Table 2** List of enset landrace names known to the Hadiya community maintained on the farmers' homegardens and their distribution status

| No | Status of enset landraces in Hadiya Zone | | | |
|---|---|---|---|---|
| | Common | Moderate | Rare | Unique |
| 1 | *Agade* | *Agandiya* | *Anchire* | *Ado* |
| 2 | *Bedededa* | *Alabite* | *Bequcho* | *Arke* |
| 3 | *Beneja* | *Astara* | *Beshiqiya* | *Ashame* |
| 4 | *Dirbo* | *Awuneda* | *Bezeria* | *Benqo* |
| 5 | *Disho* | *Ayase* | *Boshosha* | *Chalqo* |
| 6 | *Gimbo* | *Boicho* | *Bossora* | *Gasupa* |
| 7 | *Gishira* | *Dego* | *Butto* | *Gulfea* |
| 8 | *Hayiwona* | *Etine* | *Danxicho* | *Kerqerea* |
| 9 | *Hiniba* | *Gariya* | *Feraziya* | *Laddare* |
| 10 | *Merza* | *Hanzena* | *Gagabo* | *Ladore* |
| 11 | *Moche* | *Jegireda* | *Gemmera* | *Lokanda* |
| 12 | *Oniya* | *Kaseta* | *Geremeda* | *Mazawora* |
| 13 | *Separa* | *Kekera* | *Ginawe* | *Qeteqeta* |
| 14 | *Shate* | *Korina* | *Gomersa* | *Wee'a* |
| 15 | *Sherafire* | *Lechebo* | *Gozoda* | *Xiggo* |
| 16 | *Shewora* | *Manduluqa* | *Gudere* | |
| 17 | *Sisqella* | *Mariye* | *Haqucho* | |
| 18 | *Unjame* | *Mesmesia* | *Hyrio* | |
| 19 | *Uzguruza* | *Mutite* | *Lendwesa* | |
| 20 | *Xorora* | *Necho* | *Leqeqa* | |
| 21 | *Zobira* | *Orada* | *Meqelwesa* | |
| 22 | | *Qiniwara* | *Michorera* | |
| 23 | | *Qombotira* | *Ososa* | |
| 24 | | *Quina* | *Qargae* | |
| 25 | | *Shellege* | *Qebere* | |
| 26 | | *Soqido* | *Qenchowa* | |
| 27 | | *Tegadeda* | *Qeshqashe* | |
| 28 | | *Wonade* | *Qitira* | |
| 29 | | *Woshamaja* | *Sheraqa* | |
| 30 | | *Xessa* | *Sinera* | |
| 31 | | | *Suwandiya* | |
| 32 | | | *Wocherda* | |
| 33 | | | *Wohee* | |
| Total | 21 | 30 | 33 | 15 |
| % | 21.2 | 30.3 | 33.3 | 15.2 |
| Grand total | | | | 99 |

*Common* Enset landraces are found in all studied *kebeles*, *Moderate* Enset landraces occur in more than four *kebeles*, *Rare* Enset landraces are recorded in two to four *kebeles*, and *Unique* Enset landraces recorded in only one *kebele* of the studied area

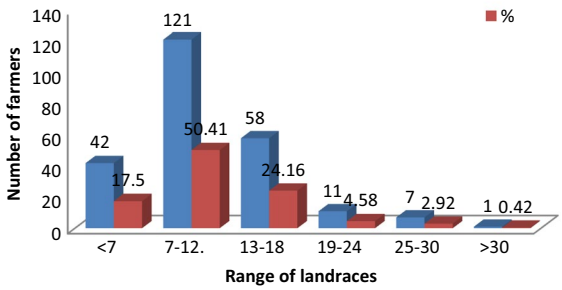


**Fig. 2** The cultivation range of the enset landraces recorded in the homegardens of the Hadiya Zone, Ethiopia

the landraces; second, they give them different local names; and finally, they classify them into various groups based on common characteristics.

*The indigenous practice of enset identification*

All the informants in the study area affirmed that they could distinguish all of their enset landraces growing in their respective homegardens based on combinations of some common identification features. They commonly used three identification characteristics: (i) four morphological characters, which include the color of pseudostem, petiole, midrib, and leaf blade (Fig. 3); (ii) agronomic characters (reaction to drought and disease, susceptibility to pests, maturity time, and vigorousness); (iii) end-use value (*qocho* and *bulla* yield and quality; *amicho* use and tastiness; fiber quality; and medicinal value). In some cases, farmers also use limited characters such as fluid color and angle of leaf orientation for identification of their enset landraces. During our discussions with local farmers about key selection criteria, the morphological characteristics of a landrace were identified as the major and first ones (Fig. 3). However, the agronomic and use-value characteristics identification criteria came only after morphological characteristics. Identification criteria such as fluid color were used for the identification of landrace *Xiggo*, which means 'the bleeding type', referring to the red fluid color oozing out upon cutting or wounding parts of the leaves and/or pseudostem as compared to the watery fluid of most of the other enset landraces. Similarly, the angle of leaf orientation as a descriptor was used for some landraces (e.g., landraces *Hiniba* and *Beneja*) known for their narrow-leaf orientation or erect leaf arrangement, whereas landraces *Oniya* and *Sisqella* were identified by most farmers as having a more bent or wide type of leaf orientation as compared to the other enset landraces (Fig. 4A).

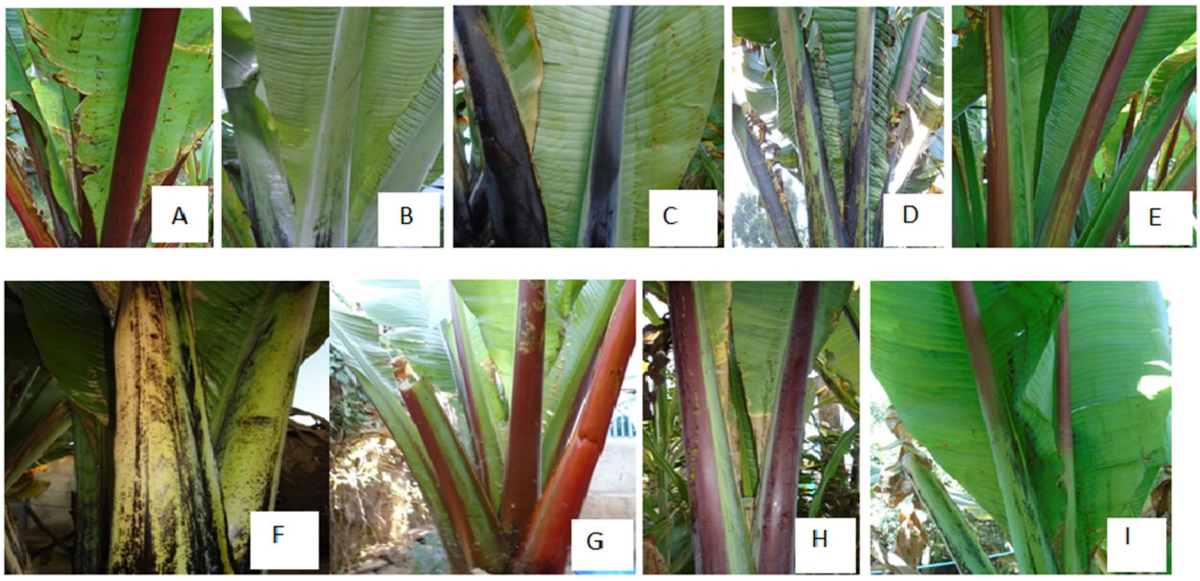


**Fig. 3** Representative morphological variation in midrib and petiole color farmers used for identification in Hadiya: **A** *Korina*; **B** *Boicho*; **C** *Qebere*; **D** *Separa*; **E** *Qombotra*; **F** *Hella*; **G** *Etine*; **H** *Astara*; **I** *Kaseta*

**Fig. 4** Variation in the angle of leaf orientation or bending and color of lamina for farmers' identification as descriptors: **A** from left to right, *Sisqella* (wide-dropping), *Hiniba* (narrow-erect), and *Separa* (intermediate); **B** color of leaf lamina, red for only landraces *Meqelwesa*, green for all others

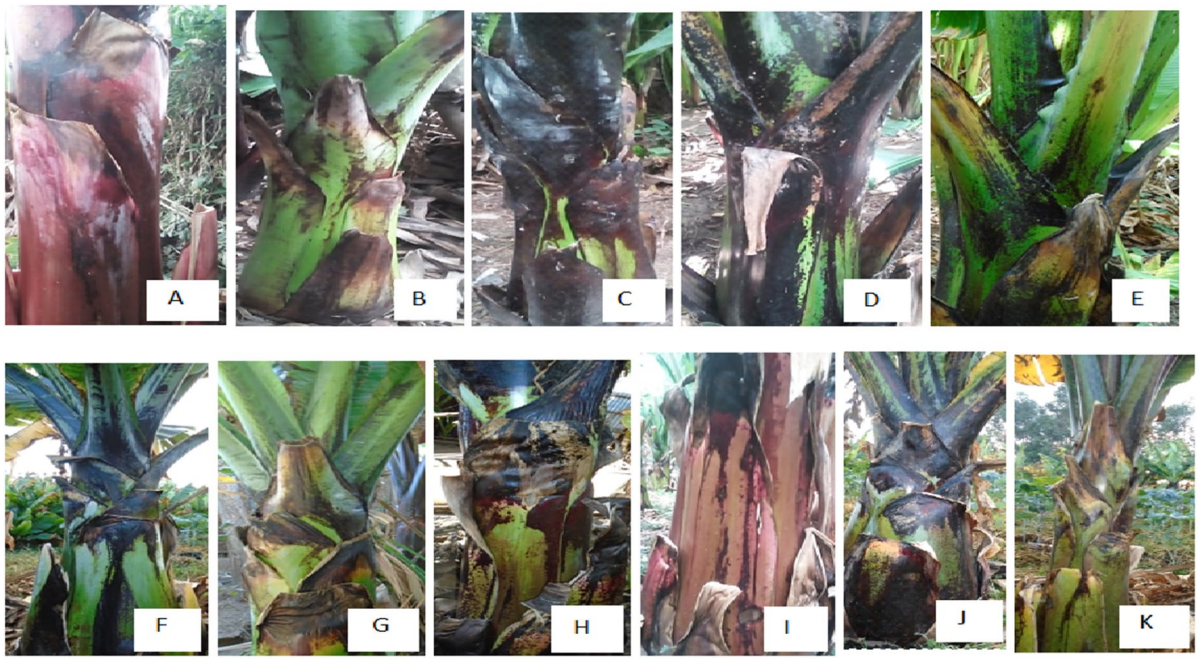


**Fig. 5** Examples of pseudostem variation in color and in end-use value: **A**-**E** landraces with sweet *amicho*, *Astara*, *Leqeqa*, *Qebere*, *Xessa,* and *Orada*, respectively: **F**–**H** landraces with non-edible and hard *amicho*, *Sisqella*, *Gishira,* and *Hella* from left to right; **I**-**K** landraces considered best in fermented products (*qocho* and *bulla*), *Gimbo*, *Separa,* and *Hiniba* from left to right

Pseudostem color, petiole strip color, and midrib color were the most frequently used characteristics (Figs. 3 and 5), while the leaf lamina color, fluid color, and angle of leaf orientation were descriptors mentioned less frequently for the identification of enset landraces by the farmers in the study area.

Almost all recorded enset landraces (Table 3) had green leaves except one enset landrace

**Table 3** The four common frequently used morphological characteristics (leaf, midrib, petiole, and pseudostem colors) and the other two descriptors

| Identification criteria (enset morphology) | Color (descriptor state) | Examples of representative landraces | Percentages of color (frequencies)% |
|---|---|---|---|
| Leaf blade color | Green | *Gimbo*, *Agade*, *Merza*, *Sisqella* | 99 |
| | Red | *Meqelwesa* | 1 |
| Midrib dorsal color | Dark-red | *Meqelwesa*, *Korina* | 2 |
| | Red | *Gimbo*, *Astara*, *Wonade*, *Etine* | 35 |
| | White-yellow | *Moche*, *Anchire*, *Sinera*, *Gudere* | 26 |
| | Green | *Hiniba*, *Shewora*, *Kaseta*, *Agade* | 33 |
| | Black | *Qebere*, *Boshosha* | 4 |
| Petiole color | Green | *Quina*, *Shewora*, *Shate*, *Agade* | 37 |
| | Red | *Gimbo*, *Wonade*, *Etine*, *Jegirada* | 29 |
| | Brown | *Hella*, *Gozoda*, *Merza* | 19 |
| | Black | *Lokanda*, *Qebere*, *Boshosha*, *Soqido* | 6 |
| | Gray | *Hayiwona*, *Sherafire, Awunada* | 9 |
| Pseudostem color | Dark-red | *Korina*, *Meqelwesa* | 2 |
| | Green | *Hiniba*, *Agade*, *Kaseta*, *Xorora* | 31 |
| | Red | *Gimbo*, *Astara*, *Wonade*, *Etine* | 19 |
| | White-yellow | *Moche*, *Anchire*, *Sinera*, *Gariya* | 28 |
| | Brown | *Separa*, *Gozoda*, *Merza*, *Unjame* | 10 |
| | Black | *Boshosha*, *Qebere*, *Soqido*, *Lokanda* | 4 |
| | Gray | *Hayiwona, Awunada, Ososa* | 6 |
| Pattern of leaf growth | Narrow-erect | *Hiniba*, *Hyrio, Beneja* | 4 |
| | Intermediate Wide-dropping | *Gimbo*, *Wonade*, *Boicho*, *Separa* | 92 |
| | | *Oniya*, *Qebere*, *Sisqella* | 4 |
| Fluid (sap) color | Red fluid | *Xiggo* | 1 |
| | Watery fluid | All other landraces | 99 |

named *Meqelwesa* with a deep red leaf lamina (Fig. 4B). For the color of the midrib, the dominant colors were: 35% red; 33% green; 26% white-yellow pigmented; and the black and dark-red pigments accounted for only 4% and 2% of the landraces, respectively. For petiole, the green color was in 37% of the landraces, red in 29%, brown in 19%, gray in 9%, and black in 6% of the landraces. Green and white-yellow were the major pseudostem colors in 31% and 28%, respectively, whereas gray (6%), black (4%), and dark-red (2%) were the least occurring pigments in landraces. As regards leaf shape and pattern, the intermediate leaf orientation was dominant, accounting for 91%, while narrow-erect and wide-dropping patterns each accounted for 4% (Fig. 4A). With sap or fluid color, only one enset landrace, *Xiggo,* was recorded as having red fluid.

### *Farmers' names and naming of enset landraces at locality level*

In Hadiya, after identification, enset growers give distinct vernacular names for each landrace based on several attributes, which can either be external appearance or internal quality. Farmers can easily distinguish each landrace from others based on their local names. The names of landraces were often consistent and shared among the farmers, and each name usually reflected a clear variation of each landrace from the others. However, in this study, we observed that some enset landraces have alternative local names given by farmers; e.g., *Ayase*, *Butto*, and *Gulfea* are also known as *Hella*, *Birwesa*, and *Fecheche*, respectively.

Farmers always refer to the local names of enset landraces when propagating, planting, managing,

**Table 4** Examples of local enset landrace names with their meanings, descriptions, and identification criteria for the naming in Hadiya, southern Ethiopia

| Examples of local landrace names with their meaning | Description of the landrace name | Local naming of landraces after the morphological, agronomic and other features |
|---|---|---|
| *Ado* (milk) | Referring to the white or creamy color of the pseudostem and midrib | Typical morphological trait |
| *Xiggo* (bleeding) | Referring to the red fluid from the midrib | |
| *Butto* ( mixture of black and white) | Indicating the spotted petiole and pseudostem | |
| *Chalqo* (weak, unable to stand) | Leaf and pseudostem strength | |
| *Qeshqeshe* (fragile) *Qombotira* (fragile) | Implying pseudostem and corm strength | |
| *Necho* (thin) | Referring to the size of a leaf | |
| *Gimbo* (huge), *Jegirada* (as tall as pillars), *Benqo* (the thunder) | Implying size and length | |
| *Gagabo* (fast) | Indicate the early maturity of the landrace | Typical agronomic feature |
| *Lendwesa* (girl's enset) | Easily harvestable | |
| *Unjame* (gets less attention) | Implying fewer managements and care to cultivate it | |
| *Qebere* (wide, bended) | Implying the pattern of growth | |
| *Bequcho* (mule), *Moche* (wild) | Indicating the strength during harvesting | Name of animals, person, local river, and origin of the place or source |
| *Gudere* (name of local river) | Referring to the place where landrace was obtained | |
| *Mesmesicho* (Clan group in Hadiya) | | |
| *Lechebo* (name of the people) | Implying the name of the person who introduced landrace to the area | |
| *Gemera* (name of the person) | | |
| *Soqido* (salt), *Shate* (bitter) | Implying the taste of *amicho* and other parts | Cooking or other qualities of landraces |
| *Sisqella* (break bamboo, the screptors) | Implying the strength during harvesting | Traditional harvesting tools |
| *Meqelwesa* (placental enset) | Implies its importance to expel the placenta | Typical traditional use of landrace |
| *Bezeria** (gust) | Indicating the suitability of the corm to feed the visitors | Landraces may be borrowed with their names from the neighboring ethnic group |
| *Feraziya** (horse) | Referring to the size of the enset | |
| *Wonade** (mare) | | |
| *Hyiro*** (the sun) | Reflects the color of the landrace | |

* and **Landraces may have been borrowed with their names from the neighboring zones Gurage and Silte, respectively

harvesting, utilizing, and exchanging enset planting material in the study area. A general vernacular term used as a local name for enset in Hadiya is *Wesho* (singular), and *Wessa* is the plural form of the name for the enset plant. The local names given to some enset landraces are usually indicators of variation and reveal the uniqueness of landraces in morphological traits, places of origin, agronomic features, and quality attributes (taste and color) of end products (Table 4). For instance, the local names reflect a broad spectrum of information and may include indications of observed phenomena (e.g., *Benqo*, the Thunder), names of places, landrace names (e.g., *Gudere*, the name of the local river), and animals (e.g., *Bequcho*, mule, and *Moche*, wild) (Table 4). Local farmers also used different criteria to distinguish their enset landraces in the homegarden such as literally using words in the local language to describe the specific morphological characters (e.g., *Jegirade*, tall; *Ado*, milk); growth attributes (e.g., *Gimbo*, the huge); and cooking quality attributes of specific landraces (e.g., *Soqido*, salt, referring to the taste of the

boiled corm or *amicho*). Sometimes, the local names are given based on the functional attributes (e.g., *Meqelwesa,* placental enset; *Sisqella*, repels or breaks the scraping bamboo; and *Unjame,* gets less attention from growers and users) and other peculiar characters (e.g., *Xiggo,* bleeding; red fluid from its parts; and *Lendwesa*, girl's enset) (Table 4).

The majority of enset local names are single expressions, 'semantically unitary. However, a limited number of the identified landrace names are organized into 'secondary' names by adding modifiers that further describe the landrace. For instance, landrace local names *Qedel-sisqella*, *Hemach-sisqella*, *Buch-xorora*, *Buch-gariya*, *Kesher-bedadeda,* and *Hemach-bedadeda* are derived from 'primary' landrace names *Sisqella*, *Xorora*, *Gariya*, and *Bedadeda,* respectively; the additional modifiers describe the color of the landraces. In general, the local names regularly describe some salient features and information about the enset landraces or their parts, in which the local farmers are interested, and it makes communication easier. However, the majority of enset landrace names do not refer to anything obvious; they are simply names for differentiating one enset type from others, or else the linkage is no longer traceable to the original name due to modification over a long period.

*Farmers grouping systems of enset landraces*

In Hadiya, enset growers, after identification and naming, classify their enset landraces according to their cultural competence, experience, and interest. Local farmers in the study area use different traditional classification systems for their enset landraces. Almost all of the respondents agree that enset landraces are mostly grown for food, fodder, fiber, and medicinal purposes. However, landrace *Meqelwesa* is planted only for its traditional medicinal values. Generally, all other enset landraces were cultivated for both food and non-food uses.

Based on focus group discussion and key informants, cultivated enset landraces are classified into two general groups according to their functionality or characteristics regarding the strength of harvesting and processing, rate of fermentation, and quality of end value (product and usage). These were grouped as 'soft' (*qechalwesa*) and 'hardy' (*qoxalwesa*) enset landraces**.** According to them, 'soft' enset (*qechalwesa*) landraces are easily harvestable and involve simple processing, early fermentation, less fibrous, and more preferable products. In addition, this group includes the majority of medicinally important landraces. Regarding corm cooking quality or palatability (*amicho* taste), farmers also classify 'soft' enset landraces into three subgroups: sweet, medium, and inedible types. Farmers in Hadiya listed out over 31 enset landraces with sweet *amicho* (tender corm). Some examples of those landraces were *Soqido*, *Leqeqa*, *Xorora, Astara, Qiniwara, Orada, Gariya, Qebere, Quina, Qombotira, Qorate, Mazawora, Ososa, Arke, Qeshiqeshe, Korina, Agandiya, Boshosha, Boicho, Gozoda, Xessa,* and *Shereqa*. The enset landraces have edible corm (*amicho*), although they were ranked in the second position (*amicho* with a medium taste), which includes *Agade, Separa, Tegededa, Mutite*, *Ancheqera, Hayiwona, Hiniba, Shewora, Gimbo, Kekera, Etine,* and *Zobira.* The 'soft' enset landraces with inedible corm types include *Shate*, *Woshemaja*, *Necho*, *Menduluke*, *Moche*, *Oniya*, and *Hanzana*. The landrace *Shate* is known by most farmers for the bitter taste of all its parts, and it is considered to have better resistance to some enset diseases, including the disease locally known as *alloya,* which may be a kind of bacterial wilt that commonly affects enset crops.

According to the local farmers' characterization, 'hardy' enset (*qoxalwesa*) landraces also have specific characteristics that differ from those of the 'soft' enset group, such as difficulty in harvesting and processing, late fermentation, more fibrous, unpalatable corms, being less attractive to mammalian pests, and being more tolerant to drought. These landraces include *Sisqella, Disho, Unjame, Bequcho, Gishira, Anchire, Shelleqe, Beshiqiya, Dirbo, Qitira, Lendwesa, Sisasira, Dego, Hella,* and *Lokanda*. Some are early maturing (e.g., *Sisqella* and *Disho*), while landraces such as *Anchire* and *Shelleqe* are late maturing. *Sisqella*, *Disho,* and *Gishira* were more common landraces, whereas *Bequcho*, *Lendwesa*, and *Anchire* were rare in all the study sites. Farmers in the study area select *Sisqella, Unjame,* and *Disho* landraces to be the best not only in terms of yield but also in terms of quality such as strength, length, and durability of fiber production. These enset landraces are among the most commonly used types

for livestock fodder during the scarcity of grasses. Out of the described 'hardy' enset (*qoxalwesa*) landraces, only *Gishira* was perceived as medicinal for humans and livestock, but most of the other medicinal enset landraces belong to the 'soft' enset landrace category.

In the study area, very few farmers used other classification criteria to classify enset landraces based on their adaptability to different ecosystems at higher elevations. They grouped *Hansawa wesa* (high altitude) and *Kala wesa* (low altitude) enset landraces. However, while the majority of the landraces can be adapted to both highlands and lowlands, the farmers claim that some 'soft' enset landraces are specifically adapted to *Hansawa* ecosystems.

## Indigenous use of enset

### *The traditional food of enset*

In Hadiya, every household cultivates enset in their homegarden as the main staple or co-staple food crop, and different dishes are derived from three primary enset products (*wassa* or *qocho, buoo* or *bulla*, and *hamicho or amicho*). In Hadiya, the term '*wassa'* represents both steam-baked flat bread and the fermented mixture of the decorticated pseudostem, grated corm, and *gammama* (starter). The *gammama* (starter*)* is prepared in the central part of the corm, while in the ground, by pulverizing using the serrated end of a wooden tool locally known as *a Jango,* and this results in a bowl-shaped cavity at the center of the corm. Subsequently, the empty sides of the hollowed-out corm cavity are rubbed by the pre-fermented central pith of the pseudostem of the young enset, followed by adding the chopped pieces of the pith (the soft and central) from the center of the pseudostem. In addition, clean water is added and mixed within the cavity. The filled cavity of the corm is tightly wrapped with enset leaves and leaf sheaths, which are left attached at the base for the final package. A heavy load is placed on the pack and left until it is fermented and required for use. Of the primary enset products, *qocho* is the most commonly consumed and largely produced. According to the farmers interviewed, the favored *qocho* type is white, while the lowest grade is brown. They also identified that most enset landraces have good *qocho* quality when harvested immediately upon flower setting. Based upon the information obtained from the individual interviews, the key informant, and focus group discussions, Hadiya farmers distinguish three types of *qocho* (fermented enset products): (i) *Tiqoota* is the *qocho* type prepared by mixing the decorticated pseudostem and grated corm of enset with early fermenting landraces without the need for adding starter or *gammama*. The *gammama* is mostly prepared with *Gimbo*, *Shirafire*, *Uzguruza*, and others. This *qocho* can be ready for consumption within 8 to 10 days. It is considered a 'poor household's food, regularly eaten in seasons of food scarcity. The favored enset landraces for *tiqoota* are 'soft' enset types. (ii) *Buhesso* is also a type of *qocho* prepared from the early fermented enset groups but by adding the starters, or *gammama*. It is also available for consumption within 10–15 days. (iii) *Gojjo'o* is the *qocho* type prepared from the scraped pseudostem and grated corm of any enset ('hard' and 'soft') types mixed with *gammama* (starter). It is usually available for feeding after a month; in addition, it can be stored for a long period. In the community, *gojjo'o* is considered the best type of *qocho* because of its longer fermentation period. People in the study area believe that the longer the fermentation period, the higher the *qocho* quality.

*Bulla,* locally called *buoo,* is obtained by squeezing a mixture of the unfermented decorticated pseudostem and pulverized or grated corm. It is considered the best-quality enset food and is obtained mainly from fully mature enset plants. The local farmers frequently mentioned that enset landraces such as *Gimbo*, *Separa*, *Hiniba*, *Hayiwona*, *Awunada*, *Beneja*, *Astara, and Etine* are known for the production of quality *bulla* as they give white and visually more attractive food products. The Hadiya community indicated that a variety of dishes prepared from *bulla* are traditionally incorporated into different cultural and religious events, such as births, male circumcision ceremonies, weddings, and festivals. During births, a postnatal mother eats *moqqa*, which is a special porridge prepared from *bulla* by mixing it with butter and spices. The traditional festival of the New Year in Hadiya, called Yaa-hode (in September, *Masqala*), is celebrated by eating special enset foods. The main and most known of them is called *atakana*. *Atakana* is made mainly from dried, powdered, and roasted *bulla* on flat clay or iron material and then cooled. To make it suitable to be eaten with

a spoon, it is spiced with various ingredients, such as milk (yogurt), cheese, and purified butter. *Atakana* is usually prepared for special guests (visitors) and some other special occasions; in addition, it is typically consumed on the eve of Yaa-hode and throughout the celebration weeks. Different *bulla dishes* also serve as traditional medicinal value to treat different health problems, including bone fractures and muscle cramps in humans.

*Hamicho* (*Amicho*) is the cooked enset corm, usually of a medium-aged enset or before the flowering of the plant, and eaten directly with no processing separately like other tubers or with other foods such as dairy products and vegetables. Therefore, it is commonly harvested for immediate consumption. In Hadiya, the enset growers distinguish and prefer some enset landraces for *hamicho* (cooking type). Landraces such as *Astara*, *Soqido*, *Qiniwara*, *Leqeqa*, *Gariya*, *Quina, Orada, Qebere, and Xorora* were highly recognized by the local people for their *amicho* consumption. These enset groups are conserved and managed with special care. For instance, before the harvesting stage, supplying wood ashes and other household wastes is preferable in the local communities rather than using animal manure for the *amicho* (cooking type) landraces. Farmers consider that frequent manuring will reduce the palatability of *amicho* (cooked corm). However, manuring these landraces at early stages is a common practice by local farmers, and it is also used to keep mammalian pests (e.g., porcupines) out of the enset field. In the study area, female farmers indicated that the amount and quality of the corms are among the best components that affect the quality and yield of *qocho* and *bulla*. Generally, the corms of the enset plant have more useful values than their leaves and pseudostem.

*Traditional medicinal use of enset*

Many enset landraces have played a crucial role as a source of traditional medicine in the study area since time immemorial to combat different human and livestock ailments. Local farmers consider some of the enset landraces for medicinal purposes; among these, *Qiniwara*, *Astara*, *Gishira*, *Xessa*, *Gariya,* and *Agade* are commonly used by most of the local community members for problems related to bones and joints (Table 5). Enset landraces that are said to have medicinal values are also used for food and other purposes, indicating that enset is a nutraceutical plant. However, it needs to be noted that the landrace *Meqelwesa* has a deep red color in all its parts and was reported only for medicinal purposes, where the cooked corm is recommended for humans and all parts for livestock

**Table 5** Enset landraces selected for medicinal purposes to treat various ailments

| Enset landraces | Traditional treatment of ailments | Enset part (product) used and additives recommended |
|---|---|---|
| *Qiniwara*, *Xessa*, *Gishira*, *Gariya*, *Astara*, and *Agade* | Bone fractures and joint displacements | Cooked corm (*amicho*) with yoghurt |
| *Hayiwona* and *Orada* | A painful swelling and other damaged parts of the human body | |
| *Qombotira* | Muscular cramps and waist problems | |
| *Xiggo* | Kidney problems and hepatitis | |
| *Meqelwesa* | Delayed placenta | |
| *Shate* and *Moche* | Most skin infections or problems in humans | Watery fluid squeezed from the pseudostem |
| *Separa* | Coughing in children | Soup prepared from the inflorescence |
| *Hayiwona* and *Bedededa* | Dairy cows' failure to produce milk after giving delivery | The raw corm |
| *Gimbo* | Hepatitis | The prepared fresh *bulla* with milk |
| Most enset landraces | Dysentery | *Qocho* prepared from a thoroughly fermented enset products |

to discharge delayed placenta afterbirth and as an abortifacient. In the study area, local farmers indicated that the corm was the most frequently utilized part of the enset plant for purposes of traditional medicine. In a few cases, other plant materials, including inflorescence, leaves, and pseudostem, were mentioned as having medicinal value (Table 5).

*The cultural and economic value of enset*

Based on the respondent's information, cultivating and conserving a large number of enset plants around the homegardens has specific cultural value and meaning for the midland and highland dwellers of Hadiya communities. For the local people, enset is not only a food crop but also a multi-use crop and an expression of their identity. According to the informants from the study area, enset farming is an age-old agricultural practice, which indicates that local farmers and enset have been highly intimate for many generations. In the study area, it is common to overhear local community members saying, "Enset is life for us and our cattle." The cultivation of enset and the rearing of cattle are directly linked to the local people. In the study area, cultivation of enset is understood as a family inheritance and starts in childhood. However, the interviewed farmers affirmed that they independently initiated cultivating enset standing on the plot of land with various landraces they inherited from their parents in adulthood after getting married. In Hadiya, most households offer a plot of land, a cow, and an ox with diverse enset landraces to an adult married son as a longstanding tradition passed from generation to generation.

The respondents indicated that enset farming is crucial in cultural, economic, and family daily life. Farmers with a large number of and more mature enset plants around their homegardens obtain local community appreciation and particular respectful local titles (names) such as *Asmache*, *Gerada*, *Berkafatta, Abaa-gadda,* and so on for men, and *Ajete* or *I'tee* for women. These farmers and their households are considered rich in the community, which reveals the cultural values of enset in determining the social position or recognition as a higher social class and its high intimacy with the community. As much as it places one in a higher social class, the extent of enset ownership also places one in a higher wealth status and hence, in a higher economic level.

The gender roles in management and use of enset

According to informants' responses and our field observation, female farmers play key roles in different kinds of day-to-day activities with enset plants, such as manuring, landrace selection, harvesting, processing, storing, preparing different types of daily meals from the various products of enset, and marketing. Local farmers in the study area noted that if women were not involved in harvesting and processing the enset crop, it would be very difficult to obtain *qocho* and *bulla* from it. Moreover, female farmers can easily recognize the different landraces, their detailed features and uses, and the quality and quantity of the product of each landrace. On the other hand, men are involved in preparing the land, propagating, planting, and transplanting activities.

The enset plant is symbolically linked to the female farmers' identity, where clear gender boundaries can be recognized. The farmers at the study sites also indicated that women have control over and entirely manage the enset field because it is an important source of daily income from the sale of products and materials extracted from it. They sell *qocho*, *bulla*, fiber, fresh leaves, and mattresses (local beds). In the study area, all activities related to enset cultivation can provide women with reliable and mutual support as well as a means for social independence and economic self-sufficiency.

*Indigenous cultivation and management practice*

In Hadiya Zone, farmers regularly cultivate mixtures of enset landraces to maintain on-farm landrace diversity and to compensate harvested enset for different consumption throughout the year. This traditional cultivation pattern involves three consecutive stages: vegetative propagation, transplanting, and harvesting.

Perpetual propagation

In the study area, enset propagation is a common practice conducted by all local farmers every year to regulate the enset cycle and maintain on-farm landrace diversity. Enset growers regularly propagate diverse landraces available in the homegarden. Farmers choose an appropriate place and a mixture of landraces for propagation. Based on our field

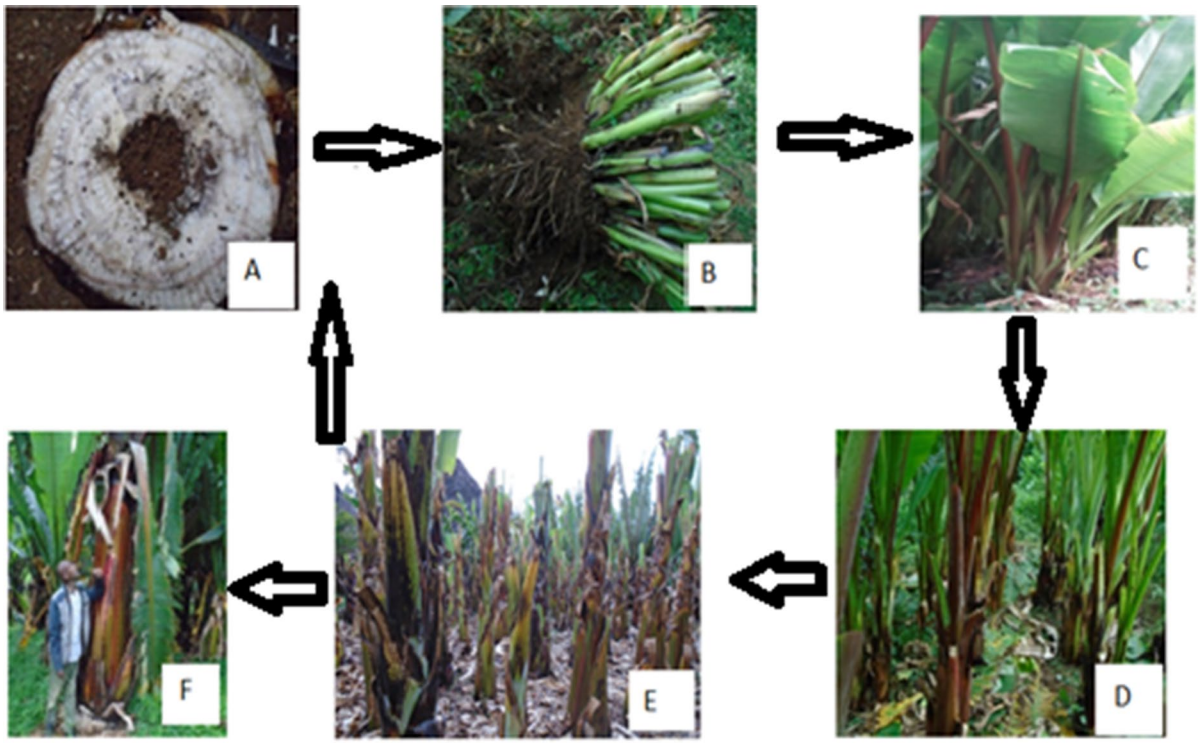


**Fig. 6** Enset propagation and transplanting practices in Hadiya: **A** A mother corm (*Hamicho*) selected from *kiniba*; **B** Emerged multiple suckers (*dubo*) ready for transplanting; **C** *Simma,* the suckers detached from mother corm and planted into a single hole as groups of 4 to 6 in batches; **D** The *lammo* suckers are transplanted in groups of 2 or 3 in the middle rows of the larger suckers known as *ogojaa*, which are planted individually in a row; **E** The *kiniba* stage is ready to transplant in the permanent field and/or for the suckers (*dubo*) production; **F** *Ballwesa,* the last stage where the enset remains permanently until harvesting

observations and interviews, all farmers use vegetative propagation from the corm of a four-year-old enset plant, locally called *kiniba* (Fig. 6A). They uproot it and cut it with a sharp knife or sickle at the junction of the pseudostem and corm. The center of the corm is removed, filled with soil to eliminate the central growing bud (apical meristem), and stored in a shaded area upside down for one or two days. The propagation is usually carried out from November (mostly highland areas) to January (commonly midland areas) on the offset of the moon. The informants indicated that eliminating the central portion helps to produce more suckers; otherwise, only one large sucker, locally known as *morra,* may be formed. The newly developed suckers, locally called *dubo,* emerge mostly after three months and remain on the mother corm for a year.

Based on their favorite types and availability, some landraces are more frequently propagated, almost every year. According to farmers' reports and the researcher's field observation, the number of suckers obtained from a single mother plant varied due to different factors such as the types and size of landraces, the season of propagation, management practices, and the amount of rainfall. Farmers in the study area reported that 30 to 150 suckers will be obtained from a single mother plant of four-years-old *kiniba* (Fig. 6B). During the interviews, farmers asserted that they believe some enset landraces are mothers or ancestors for most of the phenotypically similar and the same end-value landraces. For example, they said that *Gimbo* is considered a mother for most landraces of red (pseudostem, petiole, and midrib) color with edible *amicho* groups.

## Frequent transplanting

Enset farmers in Hadiya do not plant suckers directly in a permanent enset field as a first and last operation. Transplanting enset at different levels takes four or five growth stages before harvesting. Each stage of transplanting enset has different local names (*dubo*, *simma*, *lammo*, *ogojaa*, *erro* or *kiniba,* and *ballwesa*), as it shows the growth stage of enset (Figs. 6A–F). Farmers regularly cut all leaves, uprooting the suckers and removing roots to transplant at the newly prepared homegarden site. Transplantation is usually carried out at the onset of the rainy season (normally January and March). Farmers are not interested in planting in February. They consider that enset planted in February becomes more rooted, and with the large corm at early stages, such a situation is not preferred by farmers since frequent transplanting at each stage requires more labor and time. Enset growers in the Hadiya Zone specified the following transplanting stages and names to indicate these stages:

i. The first sucker production stage is called *dubo*; it is the stage where suckers (new shoots) usually grow in mass (clumps) on the mother corm. It takes one year before detaching and planting in a nursery.
ii. The second stage is locally called *simma* (seedlings are split into individual plants), where the suckers are split from the mother corm and planted into a single hole as groups of four to six suckers in batches. Suckers (*simma*) at this stage remain for one year.
iii. In the third year, the *simma* is transplanted into groups of two or three, and this is called *lammo*. The *lammo* suckers are transplanted in the middle rows of *ogojaa*, and they also last for a year. *Ogojaa* suckers are the larger *lammo* suckers planted individually in a row; they remain in the same place, and they take the name *erro* after the third year.
iv. During the fourth year, the *erro* enset, which has spent two years in the same place, is ready to transplant to its permanent site, and it takes a local name called *kiniba*. Farmers use *kiniba* for the suckers (*dubo*) production and to plant in the permanent field.
v. The last stage is locally known as *ballwesa*; it is the stage where the enset plant remains permanently until harvesting and flowering. An inflorescence stalk is locally called *qelimma*. This stage is selected for harvest by most women for the best quality of *qocho* and *bulla*.

## Indigenous management practice of enset diversity

Farmers in the study area maintained and managed diversified landraces of enset with limited inputs in their homegardens to meet their subsistence needs. Based on our field observation and informants' reports, their landrace composition varies according to age (*dubo, simma, lammo*, *ogojaa*, *erro* or *kiniba, and ballwesa*) (Fig. 6), fermentation and maturity rate (early and late), yield and qualities, taste attributes, medicinal requirements, and many other values and needs. Traditionally, farmer-to-farmer communications ensure the maintenance of landrace composition in homegardens. Most of the interviewed farmers (80.42%) use corms of the *kiniba* enset from their farms as sources of planting materials, but a few farmers indicated that they purchase from other farmers, receive gifts from neighbors and relatives, and exchange them for other landraces at the *kiniba* stage (Fig. 7). In the study area, enset as a source of planting material in an open market at any stage is not a common tradition, except for its final products and other materials. However, gifts for the young farmers are common traditional practices to enrich and maintain their homegardens.

In Hadiya, the enset homegardens have specific arrangements and placements for each stage of landraces and a specific order for different purposes. In

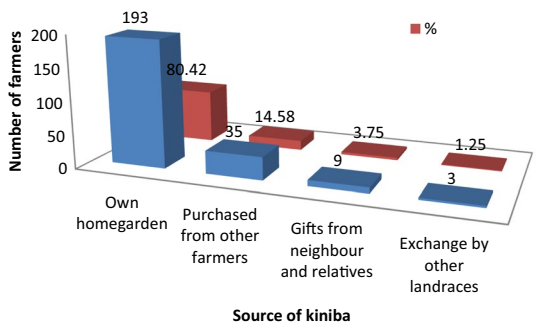


**Fig. 7** Proportion of the source of planting material (*kiniba*) in the Hadiya zone

**Fig. 8** A representative example of enset plantations and cattle feeding by enset products in a homegarden in the Hadiya Zone: **A** left side of the traditional house (*balwesa* stage) enset plantation until harvesting; the right side includes all other stages (*dubo* to *kiniba*); **B** a calf feeding on the corm of enset

the study area, well-managed and conserved enset landrace fields show attractive and respectful values for the household, which also encourages other farmers to maintain and cultivate more diverse enset landraces in their homegardens. The arrangements of enset in the homegarden around the living houses vary in composition and diversity based on age, end-use value, and preferences. On average, most of the studied enset crops on the farming sites have a typical planting pattern or arrangement. The patterns, taking the living house as a reference point, are as follows: The part in front of the house is for rearing livestock (Fig. 8B) and other social purposes; one side of the homegarden is for the cultivation or growth and transplanting of different ages of enset suckers from *dubo* to *kiniba* (the closeness to the living house is decreasing from *dubo* to *kiniba*). The other side of the living house comprises mixtures of enset (*ballwesa*), including the flowering stages (*qellima*) (Fig. 8A). The cultivation pattern also follows different arrangements on this site.

The enset landraces that have been chosen for amicho based on taste, and other qualities like medicinal value (such as *Astara*, *Leqeqa*, *Soqido*, *Qiniwara*, *Xiggo*, *Gariya*, *Orada*, *Xessa*, *Hayiwona*, and *Xorora*) are planted in the homegarden very close to home or in hideous sites because they are also extensively selected by wild mammalian pests like porcupines. Therefore, local farmers usually give special care and more protection strategies to their favorite landraces. Other enset groups, such as those recognized for their enormous size, yield, and fermentation qualities (*Gimbo*, *Agade*, *Zobira*, *Merza*, *Hayiwona*, *Awunda*, *Boicho*, *Beneja*, etc.), are cultivated near the residential areas. But some enset landraces such as *Sisqella*, *Unjame*, *Disho*, *Dego*, *Lokanda*, *Gishira*, *Dirbo*, *Shelleqe,* and *Anchire* are planted at peripheral sites of enset homegardens, which is related to the fact that they do not attract and are not damaged by mammalian pests. Thus, these landraces are described as requiring only limited management and protection compared to other groups.

## Discussion

### Status of enset cultivation and people attitudes in Hadiya

Based on farmers, enset cultivation is the most important agricultural system for the rural community of Hadiya. Enset is the plant of choice and a vital food security source for humans and livestock in the midland and highland communities of the study area. Many local farmers consider that enset is less vulnerable to changes in agricultural systems and environmental conditions. This local farmer's perception agrees with other earlier research on the importance of the enset crop (Alemu and Sanford 1996; Olango et al. 2014; Borrell et al. 2020). There is no part of the enset plant not used except the biological root (Brandt et al. 1997; Negash 2001). Local farmers also confirm that the production of enset does not comprise the use of chemical inputs,

and this practice is still active in the present generation. In the same manner, Brandt et al. (1997), Negash (2001), Tsegaye and Struik (2002), Olango et al. (2014), and Yemataw et al. (2016) indicated that the enset system is a well-established, sustainable, and environmentally resilient farming system that contributes to the food safety of farmers and, in particular, it serves as a food security crop in densely populated areas of the south and southwest parts of Ethiopia. The findings that showed more landraces in the rare category (33) and fewer in the unique category (15) may be related to declining phases or new introductions in the former case and may be a case of highly localized knowledge in the latter. However, still, the common category is dominant and widely distributed in most of the farmer's homegardens. This finding agrees with Tsegaye and Struik (2002) and Yemataw et al. (2016), who reported that multipurpose landraces have a wider distribution and abundance than uncommon landraces within and between regions.

## Extent of on-farm landrace diversity and richness of enset

Our results from this study show that farmers maintain a higher diversity of landraces than any other crop in their homegardens. The 99 enset landraces recorded in the present study are much higher than the 59 enset landraces reported in a previous diversity study from two sites involving 105 households in the Hadiya Zone (Tsegaye 2002). It is also higher than the 59 landraces reported by Yemataw et al. (2014) from two *woredas* involving 40 respondents from the same zone. The earlier reports are far below the number of enset landraces reported in the present study, which managed to investigate a much wider area by interviewing 240 farmer informants and conducting a significant number of focus groups. However, a direct comparison of the landrace richness documented in this study with prior reports is difficult because of differences in the number of farmers interviewed and visited, the number of sampled *woredas* and *kebeles*, and the approaches followed. Moreover, the study area is bordered by other major enset growing areas such as Kembata-Tembaro, Gurage, Silte, Dawro, and Wolaita zones and Yem special *woreda,* where the suckers are easily exchanged, and all the study areas comprise midland and highland that are more suitable for enset cultivation.

In the same manner, different ethnolinguistic communities in southern Ethiopia

maintain diverse enset landraces in their homegarden, which is similar to what we have recorded in this study. For instance, 78 landraces from Ari by Shigeta (1992), 65 from Kaffa-Shaka by Negash (2001), 79 from Sidama by Tesfaye and Ludders (2003), 105 from Gamo Gofa by Shara and Diro (2012), 111 from Kembata-Tembaro by Maryo et al. (2014), 67 from Wolayita by Olango et al. (2014), and 93 from Yem special *woreda* by Zerfu et al. (2018). Tsegaye (2002) also stated that most farmers in the study area tend to grow and keep a diverse range of enset types on their farmlands because concentrating on a single cultivar with a particular trait cannot meet different needs and addresses.

## Farmers' traditional categorization of enset landraces

The study revealed that the local farmers have amazing knowledge of the enset plant, which has been accumulated over many years and transmitted from generation to generation through oral tradition. It has played key roles in the classification, utilization, and maintenance of the available genetic diversity of enset in the study area.

In the study area, farmers, as the main growers and experts, have their own identification, local naming, and classification systems to distinguish one enset landrace from the other. The same trend was reported by Tesfaye and Ludders (2003) and Olango et al. (2014) from Sidama and Wolaita in using indigenous knowledge of biosystematics for enset landraces, respectively. In the present study, traditional identification and naming of the recorded landraces were primarily based on morphological features, unique traits, and end-use value of the plants, this agrees with the descriptors reported from other enset producing regions, such as Ari, Kefa-Sheka, Sidama, and Wolaita in southern and western Ethiopia (Shigeta

1990; Negash 2001; Tesfaye 2008; Olango et al. 2014). As indicated by Zippel and Ludders (2005), Tsehay and Kebebew (2006), and Yemataw et al. (2016), in the southern part of Ethiopia, enset-growing farmers usually distinguish and classify enset plants based on their morphological traits, such as leaf, midrib, petiole, and pseudostem color, length and width, types of use, quality (taste, palatability, color, etc.), and quantity of each distinctive product. These identification features are consistent with our results in this study.

In the studied areas, enset farmers give various local names for their landraces after identifying different features, such as morphology, its supposed origin or sources, cooking qualities, and different end uses, as shown in Table 4. Nonetheless, the meanings of the names for most of the recorded landraces were unexplained by the enset farmers in the studied areas. Similar findings have also been reported that unexplained meanings of folk names were common in other enset cultural areas of the country (Tesfaye and Ludders 2003; Olango et al. 2014; Yemataw et al. 2016). The same pattern was also perceived in other crops such as sorghum in Ethiopia (Mekbib 2007), banana in Indonesia (Hapsari et al. 2017), and cassava in Uganda (Nakabonge et al. 2018). The unexplained meaning of the name could partly be related to the loss of local knowledge that may have been obvious to knowledgeable cultivators of enset in the past. Those names that cannot be easily associated with obvious things tend to be remembered by fewer members, and as time passes, this can be further compounded if the landrace does not have special features and uses that could be associated with the name. We can probably explain it with the phenomenon known as language dynamics: some terms exist, but their meanings are no longer known by members of the community. Some names may have been borrowed from other crops (e.g., *Chalqo* and *Sinera*, from the local names of barley landraces). However, before taking the absence of meaning for a landrace as a true statement, thorough surveys have to be made within the entire area where that language is spoken, targeting a search for the meaning of the name of a particular landrace. Some landrace names recorded in this study were also described from other neighboring ethnolinguistic communities (Spring et al. 1996; Maryo et al. 2014; Yemataw et al. 2016). This might be due to farmer-to-farmer exchange of planting material among adjacent communities and could indicate such 'borrowed' landrace names between ethnolinguistic groups (Olango et al. 2014; Nakabonge et al. 2018). Farmers always refer to the folk names when planting, transplanting, managing, utilizing, giving, and exchanging enset (Shigeta 1990; Tesfaye 2008; Olango et al. 2014; Yemataw et al. 2014; Yemataw et al. 2016).

In the study area, farmers maintain and categorize their enset landraces based on their external appearances and internal features. Moreover, they not only identify each landrace and give it a unique place in their homegardens but also elucidate its life history, quality of end products, and specific use values. According to the reports from Ari, Kefa-Sheka, Wolaita, and Kembata in southern Ethiopia, farmers categorize enset landraces as having male or female features (Shigeta 1992; Alemu and Sanford 1996; Negash 2001; Tsehay and Kebebew 2006; Maryo et al. 2014; Olango et al. 2014). According to them, the male enset landraces are drought-tolerant. Female landraces are described by farmers as less vigorous, susceptible to disease, having a higher *qocho* quality, and producing edible and tasty *amicho*. In addition, they are early maturing and have poor fiber strength. But Zippel and Ludders (2005) reported three categories of enset local cultivars: male, female, and intermediate categories from the North Omo of Ethiopia. However, in the present study, categorization of enset as male or female was not a commonly practiced grouping method; instead, the primary criteria were the stiffness of landraces during harvesting and processing, rate of fermentation, and quality of the end value (product and usage). Based on these, local farmers generally grouped their enset crops into 'soft' or 'hardy' landraces**.** These results are consistent with findings reported by Kanshie (2002) from Gedeo in southern Ethiopia. The parallelism in the grouping as male and female versus hardy and soft is likely grounded on similar thoughts and understanding the anatomy and behavior of the enset crop.

## Indigenous uses of enset

### *The traditional food*

The results of this study indicated that enset is a multi-purpose crop that provides the local community with food and non-food materials. In the studied

area, farmers cultivate enset in their homegardens as the main staple or co-staple food crop. The different dishes are derived from the three primary enset products, namely: *wassa*, *or qocho*; *buoo, or bulla*; and *hamicho, or amicho*. This agrees with previous research conducted in other enset-growing regions of Ethiopia (Brandt et al. 1997; Negash 2001; Tesfaye and Ludder 2003; Olango et al. 2014; Daba and Shigeta 2016). Working with farmers, of the three types of *qocho* (fermented enset products), two of them (*tiqoota* and *buhesso)* were prepared from 'soft' enset types with or without additions of *gammama*. The other third *qocho*, *gojjo'o,* is prepared from a mixture of both 'soft' and 'hardy' enset types with the addition of *gammama* (starter). In the study area, local communities consider the recipes from *tiqoota* poor food, usually consumed in seasons of food shortages. A similar result was reported from Wolayita, southern Ethiopia (Olango et al. 2014). Farmers asserted that *wassa* or *qocho* is produced in large quantities and consumed frequently, whereas *bulla* is considered the best and most favored enset food product in the community. The specialty of *bulla* food in the Hadiya community is seen in the different dishes prepared from it traditionally served for different medicinal values as well as cultural and religious events. On the other hand, *amicho* is harvested for its immediate use as food with no processing. Similar findings were reported by Brandt et al. (1997) and Tsegaye (2002) in their country-level research.

*Traditional medicinal use of enset*

Farmers in the study area maintained several enset landraces for medicinal purposes with other landraces. According to their reports, cooked corm (*amicho*) with dairy products is often used to cure different ailments in humans. Out of the mentioned landraces, most are traditionally applied to treat bone and joint problems (Table 5). Maryo et al. (2014), Ayenew et al. (2016) from the Kembata-Tembaro Zone, and Nuraga et al. (2019) from five administrative zones and one *woreda* also described several of these landraces with similar folk names. Likewise, our results are consistent with the findings reported by Tsegaye and Struik (2002) from the same study area. In the study area, *Meqelwesa* is a landrace known for a deep red leaf, midrib, and pseudostem. The *amicho* (cooked corm) of this enset with milk stimulates delayed placental discharge after delivery in humans. In the same manner, some enset landraces were also reported from different study areas for similar treatment purposes, such as *Qeqille* by Maryo et al. (2014) from Kembata, *Asikala* by Assefa and Fitamo (2016) from Sidama, and *Choro* by Tsehay and Kebebew (2006) from Bonga, southwestern Ethiopia. This may indicate either the independent development of similar cultures, the diffusion of cultures, or both the utilization and management of crops over the years (Kujawska et al. 2017).

*Cultural and economic values of enset*

Enset has played a more significant role in meeting the cultural and economic needs of rural communities than any other crop in the study area. This study showed that farmers in Hadiya had classified as either poor or rich based on the number of mature enset crops and the numbers of livestock they owned. Enset and cattle are highly interrelated in the studied areas since different parts of enset are used as fodder for cattle, and their wastes are also used as organic fertilizers for enset crops. These imply that enset plants have a long history and strong bond with humans and animals. Sirany et al. (2022) also stated that enset crops and animals are closely linked to win–win strategies. Similarly, Alemu and Sandford (1996), Tsegaye and Struik (2002), and Waktola (2009) described a similar situation in other enset-producing communities in Ethiopia. Moreover, farmers in Hadiya obtain many social appreciations, notable respectful titles or names, and ranks from the local community based on the number and size of their enset crops. Likewise, Sirany et al. (2022) indicated that enset plants have special cultural meaning and value as an expression of identity for enset producers in Ethiopia. Therefore, enset cultivation in the community has a major socio-cultural value. In the same manner, Zippel and Alemu (1995) and Olango et al. (2014) reported that in Wolaita, a farmer with a large enset plantation and many mature (big) enset plants can immediately be recognized by outsiders as a rich and respected man. Enset is a versatile crop in the Hadiya community;

besides its food, medicinal, and socio-cultural values, it also serves as a source of income for rural communities. Alemu and Sanford (1996) also showed that enset plants can be sold sometimes and processed products like *qocho* and *bulla* are sold anytime in rural markets and towns. Therefore, it is an immediate, year-round cash income source for a household to buy their regular requirements.

*The gender roles in management and use of enset*

According to Mukhopadhyay and Pieri (1999), most farming systems have a division of labor, which determines the different tasks for which men and women are responsible. Similarly, farmers in the study areas indicated that women manage most activities of the enset since they are exclusively accountable for harvesting, processing, storing, preparing, and marketing the products. In our study, farmers revealed that male farmers were regularly involved in the early stages of activities such as land preparation, planting, and transplanting. This corroborates with the reports of Tsegaye (2002), who described that according to the men, 'it is a shame for the male to process or watch his wife process or carry enset products to the market.' Negash (2001) also stated that men believe enset processing is purely a woman's task. This indicates that it would be difficult to find any fermented enset products without the participation of women.

Female farmers in the study area also regulate extracted products such as *qocho*, *bulla*, fiber, and other materials like fresh leaves and mattresses (local beds) as an important source of regular income, which provides female farmers with social independence and economic self-sufficiency. The same situation was also reported by Shigeta (1992), Habtewold et al. (1996), Brandt et al. (1997), and Negash (2001), who described that the fermented products and also the fresh and dried parts of enset are the main source of income for women in other enset-growing regions of Ethiopia. Generally, female farmers in the Hadiya Zone, due to their high intimacy with the enset plant, have more knowledge and experience. These opportunities qualify them easily to recognize the different landraces, their detailed features and life cycles, and the yield and quality of the harvested products of each landrace. This has significant implications for women's roles in enset diversity, management, utilization, and conservation of genetic resources.

Indigenous cultivation and management practice

In Hadiya Zone, farmers regularly cultivate a mixture of enset landraces to conserve on-farm landrace diversity and to balance harvested enset for different consumptions throughout the year. Traditionally, farmers follow three consecutive cultivation stages, which include vegetative propagation, transplanting, and harvesting. Our results indicated that enset propagation is a cultural practice carried out by all farmers every year to regulate the enset cycle and maintain on-farm landrace diversity. This agrees with the reports of earlier research in different enset-growing areas of the country (Negash 2001; Tsegaye 2002; Karlsson et al. 2015; Yemataw et al. 2016; Borrell et al. 2020). Based on our field observations and interviews, most farmers use vegetative propagation from the corm of a four-year-old enset plant, locally called *kiniba*. A similar observation was also reported from other enset growing areas (Tsegaye 2002). The propagation is usually carried out from November to January, depending on the offset of the moon, which is probably related to traditional beliefs held by some farmers since they think that cultivating enset during the onset of the moon may contribute to the development of certain enset diseases and production losses. A similar traditional practice was also observed by Olango et al. (2014) in Wolaita. According to farmers in the study area, multiuse landraces are more frequently propagated than functionally specific landraces. Similarly, Yemataw et al. (2016) also indicated that multipurpose landraces are propagated almost every year. Based upon farmers' reports, the number of suckers found from a single mother enset varied due to different factors such as genotypes and size of landraces, age of landraces, management practices, and amount of rainfall. A similar report was observed by other researchers (Karlsson et al. 2015; Bosha 2018). Most farmers in the study area mentioned that 30 to 150 suckers are obtained from a single mother plant of four-year-old *kiniba*.

The results of our study revealed that transplanting enset at different levels takes four times or five growth stages before harvesting. Each stage of transplanting has various local names in the Hadiya community (*dubo*, *simma*, *lammo*, *ogojaa*, *erro,* or *kiniba,* and *ballwesa*). In the same manner, Negash (2001) and Tsegaye (2002) stated that different growth stages and transplanting steps of enset are

known in different zones of Ethiopia. Transplantation of *kiniba* to *ballwesa* usually occurs during the dry season, especially in January. However, transplanting of other stages is regularly performed at the beginning of the rainy season (normally in March). Comparable reports were shown by Negash (2001), Tsegaye (2002), and Olango et al. (2014) from Keffa-Shaka, Sidama, and Wolaita, respectively. Furthermore, all enset growers in the study area regularly prune most of the leaves at each stage, except *ballwesa*, particularly in June and the end of August. A similar observation was reported by Tsegaye and Struik (2002). Olango et al. (2014) indicated that the third stage in the Wolaita area is used as both the source of mother corm for sucker multiplication and harvested for consumption when there is less food in the family stock. In the same way, *kiniba* or *erro* stages are also used as the source of mother plants for sucker production in the study area. However, harvesting for human consumption at any stage, except *ballwesa,* is not common practice in the Hadiya community.

## Conclusion

The information obtained from this study indicates that local farmers have a great wealth of knowledge on the naming, classification, utilization, and management of enset landraces in the Hadiya Zone. In the study area, enset is a vital and multipurpose crop; throughout the growth stage, every part is used for food and non-food purposes by most farm households. Enset, a food and fodder security crop, could not be substituted by other crops for the enset farming communities in the study area. With their daily association and knowledge accumulated over the years, the Hadiya farmers have been cultivating and maintaining several enset landraces in their homegardens for many generations. In this study, 99 vernacular names of enset landraces growing on farmers' fields were documented. Local farmers in the study area use a combination of methods to identify, name, and classify enset landraces in their homegardens.

The morphological characteristics of a landrace are the major and key identification criteria used by local farmers. Farmers in the study area give distinct local names to each landrace they grow based on its identifying characteristics. Moreover, the local names of landraces are often consistent and shared among the people, and they also reflect variations among the landraces. Generally, landraces were named based on places of origin or sources, morphology, culinary features, maturity period, growth attribute, and functionality. However, for most enset landraces, farmers did not know the meaning of the names as recorded during the interviews. Local farmers also classify enset landraces into different groups using their long-term experiences and enriched traditional knowledge of the crop. Special conservation attention needs to be given to the rare and unique types of enset landraces.

The results from this study also provide information about the indigenous knowledge of local farmers regarding the cultural, social, and economic values of enset and its production system. Such knowledge is crucial for understanding how local community members classify, utilize, maintain, and manage the existing enset landrace diversity in their homegardens and is a vital resource for the improvement and development of the crop in combinations with modern formal science.

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**Authors' contributions** TD contributed to designing the study, performing the field work, writing the original draft and final manuscript. TF and ZA contributed to supervising the research work, suggesting on the data collection and interpretation, reviewing and editing the final manuscript. All authors read and approved the final manuscript.

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**Declarations**

**Conflict of interest** The authors declare that they have no competing financial interests or personal relationships that could have appeared to influence the work.

## Appendix 1

**Survey on Enset farming systems of respondents in Hadiya zone, south Ethiopia**

| | |
|---|---|
| Name of Interviewer | |
| Date of Interview | |
| Zone | |
| Woreda (District) | |
| Kebele (Subdistrict) | |
| Name of Respondent | |
| Sex of Respondent | ◯ Male ◯ Female |
| Age of respondent | |
| Educational level of respondent | ◯ Illiterate ◯ Informal ◯ Primary ◯ Junior ◯ Secondary ◯ College |
| Marital Status of the respondent | ◯ Single ◯ Married ◯ Divorced ◯ Widowed |

**Status of enset and its production activities**

1. Do you have enset in your homegarden?

   A, yes B, no

2. If yes to question number 1, for what purpose do you plant?
3. How would you compare the cultivation of enset with other crops from your homegarden?
4. When compared to other crops, how does the enset plant respond to both excessive and insufficient rainfall?

   A, low tolerance B, medium C, high tolerance

5. Do you think that the production of enset has been replaced by the introduction of new kinds of other crops?

   A, yes B, no

6. What is your reason (s) for/to the question number 5?

**Enset landrace diversity and distribution at local level**

7. How many different types of enset landraces exist in your homegarden?
8. List all types of enset landraces cultivated on your homegarden

| No | Local name | No | Local name | No | Local name | No | Local name |
|---|---|---|---|---|---|---|---|
| 1 | | 11 | | 21 | | 31 | |
| 2 | | 12 | | 22 | | 32 | |
| 3 | | 13 | | 23 | | 33 | |
| 4 | | 14 | | 24 | | 34 | |
| 5 | | 15 | | 25 | | 35 | |
| 6 | | 16 | | 26 | | 36 | |
| 7 | | 17 | | 27 | | 37 | |
| 8 | | 18 | | 28 | | 38 | |
| 9 | | 19 | | 29 | | 39 | |
| 10 | | 20 | | 30 | | 40 | |

9. Which enset landraces are more frequent/common in your homegarden? Why?
10. Which enset landraces are moderately common in your homegarden?
11. Which enset landraces are rare or less frequent in your homegarden? Why?
12. Which enset landrace is unique (only one) in your homegarden? Why?

**Farmers' identification, naming and categorization of enset landrace**

13. Do you have any criteria by which you can identify or distinguish each enset landrace from your homegarden?

A, yes B, no

14. If yes to question number 13, list all the identification features for your landraces

15. Which identification features are more frequently used?

16. Which identification features are least frequently used?

17. Do the local names of the enset landraces have any meaning?

A, yes B, no

18. If yes to question number 17, please mention the meaning of the names

19. Do you categorize your enset landraces in different groups?

A, yes B, no

20. If yes to question number 19, what are the major criteria?

**Indigenous use of enset**

21. What is the best stage of harvesting enset for food?

A, before flowering B, after flowering C, at both stages D, at any stages

22. Which season is more preferred for harvesting enset?

A, dry season B, rainy season C, any time of the year

23. Which primary enset product(s) is/are used as human food?

A, *wassa* or *qocho* *B, buoo* or *bulla* C, *hamicho oramicho* D, all

24. Which primary enset product is more produced?

A, *wassa* or *qocho* *B, buoo* or *bulla* C, *hamicho or amicho*

25. Is there different types of *wassa* or *qocho*?

A, yes B. No

26. If yes to the number 25, would you tell me the types of *wassa* or *qocho*?

27. Which enset landrace (s) do you think is/are more preferred for the quality of *wassa* or *qocho*?

28. How long would it take for it to ferment?

29. What do you think determines the rate of fermentation?

30. Which types of enset landraces normally ferment faster?

31 Which enset landrace (s) is/are best for *buoo* (*bulla) production?*

32. Name the *buoo* cuisine, along with the occasions when it is typically prepared.

33. Which groups/categories of enset landraces normally ferment faster?

34. Which groups/ categories of enset landraces ferment slowly?

35. Which enset landrace (s) is/are normally used for *hamicho* or *amicho* (cooked corm) preparation in your homegarden?

36. Which of these landraces are regarded the best?

37. Which enset landraces are more preferred for the production of fiber in quality and quantity?

38. Do you have enset landraces particularly used for medicinal purpose?

A, yes B, no

39. If yes to question number 39, please mention landraces and the specific uses.

| Name of enset landraces | Traditional treatment of ailments | Parts (products) of enset used |
|---|---|---|
| | | |
| | | |
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| | | |
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40. Are men and women practiced different tasks in the production of enset?

A, yes B, no

41. If yes to question number 40, mention the types of occupation responsible for men, women and for both sexes.

**Indigenous cultivation and management practice**

42. When do you cut or propagate your enset landraces?

A, at rainy season B, at dry season C, at any season

43. How many enset landraces do you cut per year for *dubo* (sucker) production?

44. Which enset landrace (s) produce (s) the most *dubo* (suckers) from a mother corm?

45. Do you regularly transplant different ages of enset landraces?

A, yes B, no

46. If yes to question number 45, how often did you transplant suckers?

Specify their names and corresponding stages:

i. _____, ii, _____, iii, _____ iv. _____ v. _____

47. When do you transplant your enset landraces? Why?

48. Where do you obtain the suckers?

49. Do you need some inputs, such as fertilizers and pesticides, for enset production?

A, yes B, no

50. Do you equally care enset types in your homegarden?

A, yes B, no

51. If yes to question number 51, please mention the reason

52. Which enset landrace(s) require more management practices? Why?

53. Which enset landrace(s) require least/less management practices? Why?

54. Does a farmer who has diverse enset landraces with mature and well-managed systems in your kebele or surroundings receive any societal recognition?

A, yes B, no

55. If yes to question number 54, please mention types of such social recognition.

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