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Useful plant species diversity in homegardens and its contribution to household food security in Hawassa city, Ethiopia

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The study was conducted on homegardens of Hawassa city, Southern Ethiopia with the aim of documenting useful plant species; identifying the internal and external household factors related to useful plant species diversity in and around home gardens and examining its contribution to household food security and income generation. A random sample of 120 homegardens from eight sub-cities of Hawassa city was used to collect useful plant species data. Techniques used were focus group discussion, semi-structured interviews, home garden tour, market survey, free listing, priority ranking, and preference ranking. A total of 258 useful plant species were documented, of which 47.29% were ornamental plants, 29.75% food plants, and 15.89% medicinal plants. Fabaceae was the dominant family represented by 9 genera and 20 species, followed by Euphorbiaceae and Asteraceae with 17 and 16 species each respectively. Homegarden size of the study area ranged from 220 to 1235 m² with a mean size of 571 m². The age of homegarden is ranged from 15 years old to 55 years old with a mean aged of 28. The number of species in the homegarden ranges from 10 to 45 with the mean of 23. The study indicates that home gardens are contributing to food security, income generation and livelihoods in Hawassa city through production of ornamental, food plants, fodder, medicinal, timber and construction. The study recommended that the management of useful plant species in homegardens will be scaled up and further expanded and assisted by agricultural extensions in urban areas in Ethiopia.

Key words: Urban home garden, plant species diversity, household livelihood, food security.

INTRODUCTION

Homegardens are production system of diverse crop plants, which is easily accessible and adjacent to household (Sunwar et al., 2006). It is the site of highest species diversity where several landraces, cultivars and rare/endangered species have been maintained and

conserved (Watson and Eyzaguirre, 2002). The compositions of crops grown in home gardens can be grouped based on function as ornamental, fruits, food crops, vegetables, medicinal, spices and fodder, building materials and fuel woods (Kumar and Nair, 2004).

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Homegarden systems provide an additional food supply and cash income for the people (Das and Das, 2005).

Worldwide, homegardens are a community's most adaptable and accessible land resources and important components in reducing vulnerability and ensuring food security (Buchmann, 2009). The features of homegardens are year round production of food, decreased risks of production failure due to high diversity of species, increased resource productivity over time, expansion of the amount and quality of labour applied in the farm, provision of output flexibility and alternative production (Senanayake et al., 2009).

Homegardens in Ethiopia may broadly be categorized into two types (Zemede, 2001; Tesfaye, 2005). The first category of home gardens is small-sized gardens in which vegetables, spices, oil seeds and fruits are cultivated to supplement cereals and pulses raised in adjoining fields. This type of gardens is characteristic of cereal crop based farming areas of the country and is also found in urban centers. The other type of homegardens, which is characterized by a diverse mixture of crop plants with *enset* (*Ensete ventricosum*) making the basic framework, is that found in the south and southwestern part of the country. Advocates of gardening cite evidence that home gardening can be a sustainable strategy for improving food security and incomes when gardens are well adapted to local agronomic and resource conditions, cultural traditions and preferences (Midmore et al., 1991; IIRR, 1991). Plant diversity is often used as a measure of health of biological system (Naeem, 2002). It is threatened by the agricultural expansion, deforestation, and development activities including rapid urban expansion (Ricketts and Imhoff, 2003). Urbanization is one of the recent important issues in the enormous reduction of plant diversity. Currently the world urban population (3.2 billion) exceeds the number living in rural areas. People create rapid demands for food, settlements, jobs, waste management, and all basic needs for living (Rizvi, 2007). Dense settlements, traffic congestion, air and soil pollution, and waste dumps, reduce the space for plants, especially natural domestic plants (Mckinney, 2002).

Although urbanization is a global phenomenon, its magnitude differs widely among regions (Reid, 1998). In Ethiopia, cities are currently growing rapidly. Hence addressing the global problem of reversing plant diversity in urban areas requires multiple innovative ways. Urban and suburban home gardens play a major role in providing food, breeding sites, shelter for animals and plants also modifying microclimate (Smith et al., 2006).

In the present study most of the useful plant species diversity are almost lost by human impact and hence, there is glaring loss of biodiversity, disruption of indigenous knowledge, practices and culture are becoming evident due to limited integration of traditional practices and modern science in the study area, and the value of traditional home gardening in the conservation

and management of useful plant species by indigenous people of Hawassa city is minimal and there is a problem of food insecurity in and around Hawassa city (Reta, 2013). Thus, the purpose of this study was to document, identify the internal and external household factors related to useful plant species diversity in and around home gardens of Hawassa city and examining its contribution to the household food security.

MATERIALS AND METHODS

Study area

The study was conducted in homegardens of Hawassa city (07° 05' latitude North and 38°29' longitude east) with an altitude of 1680 m above sea level and covers total area of 157.2 km² and has a mean annual rainfall and temperature of 953.4 mm and 20.3°C, respectively (SNNPRS, 2005). Hawassa is the capital city of Southern Nations, Nationalities and Peoples Regional state and Sidama zone, located 273 km from Addis Ababa, capital of Ethiopia. It is surrounded by Lake Hawassa in the west, Hawassa zuria woreda in the south and east part and Oromiya Region in the north. Based on figures from CSA (2007), Hawassa city has an estimated population of 304,479; it is home to about more than 50 ethnic groups. Each ethnic group has their own composition of tribes with distinctive language, custom, traditional beliefs and cultural diversity. It is sub divided into 8 sub city, namely Tabore, Hayekdar, Menaharia, Misrak, Bahale adarash, Addis Ketema, Mehale Ketema and Awela Tula in which the present study was carried out and 32 kebeles (Figure 1). The land form is plain with reddish volcano soil which is ideal for construction.

Data collection

The study of homegarden was carried out in the Hawassa city in 2014. Field work was conducted during the period from February 2014 to September 2015. Each site was visited three times including the reconnaissance survey. Techniques used were homegarden tour, complete plant inventory, focus group discussion, semi-structured interviews, free listing, market survey, priority ranking, and preference ranking. The interview and discussions was conducted in Amharic language and translated into English language during data analysis. Ethno botanical techniques were employed to collect data on knowledge and management of home garden plants used by people in Hawassa city as described in Martin (1995) and Cotton (1996). A total of 120 home gardens were randomly selected from seven sub cities (17 homegardens from each sub city). Forty five homegardens (6 from each sub city) were preferentially selected for detailed study, which represented 37.5% of the garden visited. The distance between each home garden was 300 m apart. During the different visits to the households semi-structured interviews with both household heads were conducted on different aspects: Categories of use of plants in the garden; preferred useful plant species by home gardeners, planting, consumption, income they get, benefits and source habitats of spicy plants; history of the garden, observed change in home garden composition; perception and valuing of diversity; local resource use pattern, challenges and constraints and categorization and local religious practices. Information obtained was recorded and coded for latter analysis.

Data analysis

Descriptive statics such frequency and percentage was used for

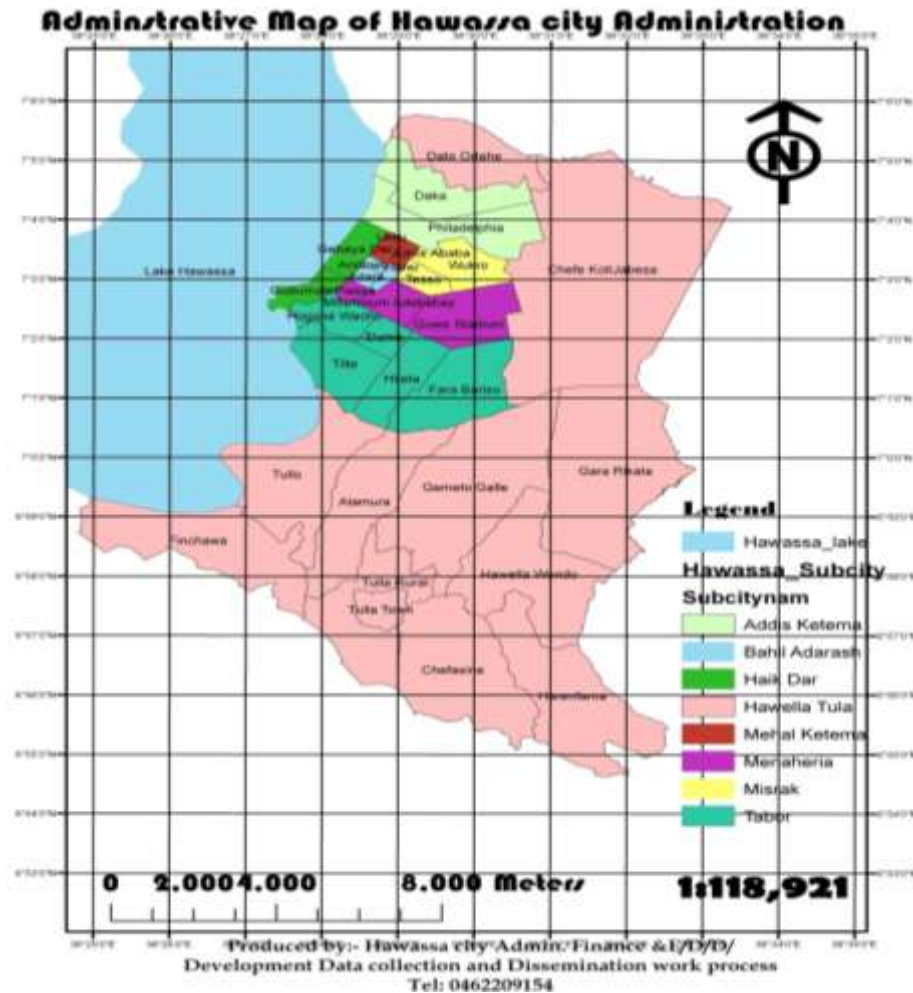


Figure 1. Map of the study area showing the study site (HCA, 2011).

analysis and summarizing the data. The diversity indices, Shannon-Weaver index (SWI), Evenness index and Simpson's index were employed to determine the species richness, evenness and dominance of the species in the homegardens. Free listing was used by asking participants to list the name of all useful plants found in their homegardens and the uses of each plant. Jaccard's similarity coefficient (JSC) was estimated for comparing homegardens number of species in eight purposively selected study areas in different regions of the country. The formula used was $JSC = c / (c+a+b)$, where, a = number of species found in the study area but not in other study site, b = number of species absent in the study area, and c = number of species common to the study area (Jaccard, 1912).

RESULTS

Useful plant species diversity

In the surveyed homegardens a total of 258 useful plant species were observed and identified, including 14(5.43%) vegetable plant species, 23 (8.92%) fruit plant species, 15(5.81%) spices plant species, 12(4.65%) root and tubers plant species, 8(3.1%) cereals, pulses and oil

seeds plant species, 3(1.16%) stimulant plant species, 12(4.65%) fragrant plant species, 122(47.29%) ornamental plant species, 39(15.12%) firewood plant species, 4(1.55%) animal feed plant species and 41 (15.89%) medicinal plant species. The average plant species per household was 21 ranging from 10 to 45 throughout the homegardens.

A total of 258 plant species belonging to 186 genera and 76 families were inventoried from home gardens of Hawassa city. Fabaceae was the highest number of species followed by Euphorbiaceae and Asteraceae. The genera represented by the highest number of species were Euphorbia (8 species) followed by Astera 7 species. Out of the 258 useful plant species 244 species were Angiosperms, 10 species were Gymnosperms and 4 species were Pteridophytes.

Multipurpose trees showed the highest and the most frequent occurrence (Appendix I and II). Useful species such as *Cordia africana*, *Moringa stenopetala*, *Melia azerdarch*, *Croton macrostachys*, *Calpurea aurea* were showed the highest frequency. The most cultivated useful

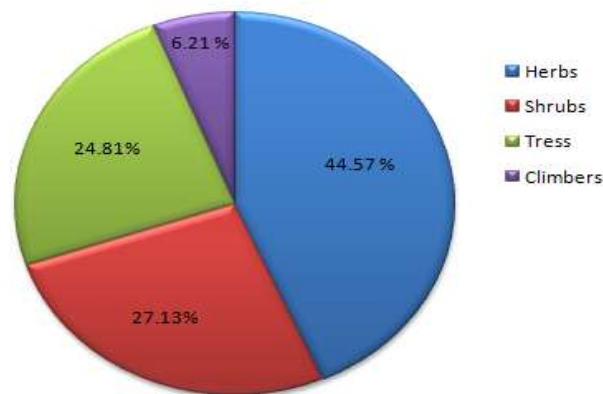


Figure 2. Percentage of useful plant species by their habits in the study homegardens.

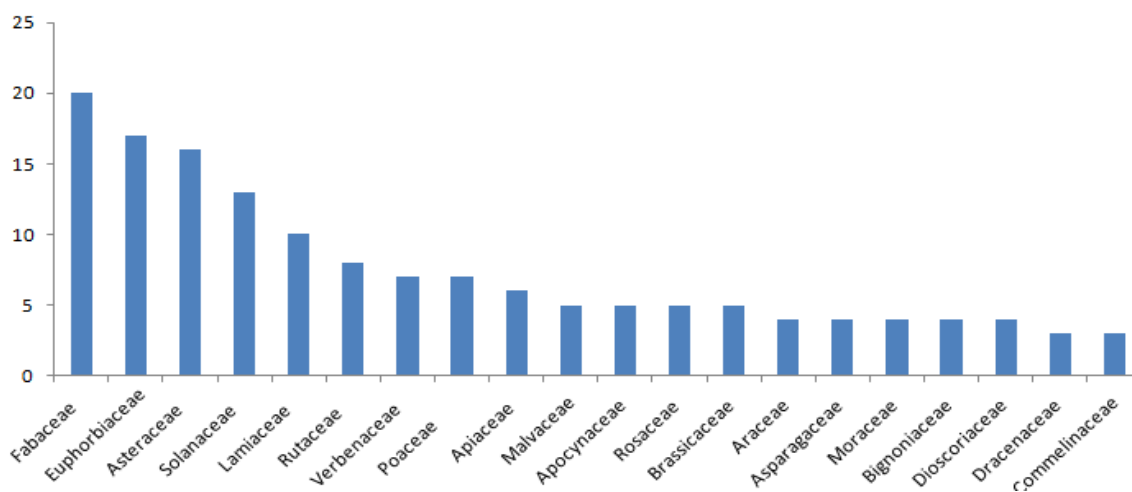


Figure 3. Top 20 useful plant species family diversity in the homegardens of Hawassa city.

food plant species in the homegarden were *Enset ventricosum*, *Carica papaya*, *Persea americana*, *Coffea arabica*, *Musa paradisca*, *Mangifera indica* and *Zea mays*.

Most species (83% of identified) were cultivated, 5% were both cultivated and wild, 12% were wild plants. Most home garden species were perennials (83%), annuals (15%) and biennials (2%). Among 258 species, 64 species (24.8%) were trees, 70 (27.13%) shrubs, 115 (44.57%) herbs, 16 (6.2%) climbers (Figure 2). Herbs were the most numerous species in the homegardens studied followed by shrubs (27.13%), trees 64(24.8%) and climbers 16(6.2%). Among 258 useful plant species recorded, 83(32.17%) was native to Ethiopia, 15(5.81%) was unidentified, 160 (62.02%) was introduced from other parts of the world.

Family wise distribution shows that Fabaceae is the most dominant family with 20 species; Euphorbiaceae is the second dominant family with 17 species and

Asteraceae is the third dominant family with 16 species followed by Solanaceae (13 species), Lamiaceae (10 species), Rutaceae (8 species), Verbenaceae and Poaceae (7 species each), Apiaceae (6 species); Malvaceae, Apocynaceae and Rosaceae (5 species each). The twenty most dominant families represent 150(27.9%) of the total number of species recorded. Top 20 useful plant species families in the home garden of Hawassa city are given in Figure 3.

Food plants

The food plant constitutes 72(27.91%) species of the total useful plant flora of Hawassa city home garden. Among food plants fruits comprises 23(31.94%), spices 15(20.83%), vegetables 14(19.4%), root and tuber crops 12(16.7%), cereals, pulses and oils 8(11.11%). A high number of food plants belonged to the Dioscoriaceae,

Lamiaceae and Rutaceae (8 species each) followed by Apiaceae and Fabaceae (5 species each), Araceae, Euphorbiaceae and Verbenaceae (4 species each), Asteraceae, and Myrtaceae (3 species each). The most widely distributed food crops are *Zea mays* with a frequency of occurrence (118), *E. ventricosum* (117), *M. paradisiaca* (115), *M. indica* (99), *C. papaya* (97), *P. americana* (89), *Sccharum officinarum* (85) and *Brassica rapa* (84) respectively (Appendix II). The majority food crops cultivated are used for household consumption. Fruit species commonly found in the study homegardens are Papaya (*Carica papaya*), Banana (*M. paradisiaca*), Avocado (*P. americana*), Guava (*Pisidium guajava*), Mango (*M. indica*), and Roman (*Punica granatum*).

Ornamental plants

The ornamental plant use category consisted of 122 species from which 18(14.75%) are native to Ethiopia, 104(85.25%) is exotic. The ornamental plant species are distributed among 73 families with Euphorbiaceae, Lamiaceae (12 species each) and Asteraceae (11 species each) presented the largest number of species corresponding to 30.7% of the total ornamental plants found in the homegardens. Most of the plants surveyed in the homegardens of Hawassa city are exotic and widely disseminated throughout Hawassa city. Ornamental plants are found in more than 87% of home gardens. The most frequently distributed ornamental plants are *Melia azedarch*, *Jacaranda mimosifolia*, *Cupressus lusitanica*, *Callistemon citrinus*, *Hibiscus rosa-sinensis*, *Senna spectabilis*, *Duranta repens*, *Duranta erecta*, *Bougainvillea glabra*, *Nerium olander*, *Terminalia mentalis*, *Araucaria heterophylla*, *Thevetia peruviana*, *cupercus lstantica* and *Ficus benjamina*.

The homegardens consisted of 122 (47.29%) of ornamental plants. Among these 208 were perennials plant species. Mean number of ornamental plant species in the homegardens was 15 with the range of 10 to 35 for all surveyed households. Euphorbiaceae contained the highest number of ornamental species (12), Asteraceae is the second number of ornamental species with 11 species, Verbenaceae and Malvaceae contained 5 species each, while Asparagaceae, Lamiaceae, Apocynaceae and Bignoniaceae contained 4 species each.

Medicinal plants

A total of 41 plant species with medicinal value were recorded and this accounted for 15.89% of the total plant species documented. Species of family Asteraceae and Solanaceae were the most used for remedies representing nearly 24.39% of all medicinal plants. The majority of medicinal plants are herbs 16 (39.02%)

followed by trees 15(36.58%), shrubs 9(21.95%), climbers 1(2.44%). The most frequently utilized plant parts were leaf 22(53.66%), stem 8(19.51%) followed by root 6 (14.63%). Ninety seven percent of medicinal plants documented in the study area are indigenous. Top ten medicinal plants species occurred in more than 50% of the homegardens, namely *Achranthes aspera*, *C. papaya*, *Artemisia absinthium*, *Artemisia afra*, *Ocimum lamiifolium*, *Withania somnifera*, *Vernonia amygdalina*, *Ruta chalepensis*, *Croton macrostachyus* and *Cucumis ficifolius* (Appendix III).

Spices

A total of 16 spices plant species were documented. It is distributed among 8 genera and 9 families. Spices plants consisting of 6.202% of the total useul plant species documented. A high number of spices belonged to Lamiaceae (5 species), Alliaceae (2 species), Solanaceae (2 species), verbenaceae (2), and Rutaceae and Brassicaceae (1 species each). The most commonly used spices were *Allium sativum* (Onion), *Allium cepa*, *R. chalpensis*, *Zingiber officinale*, *Rosmarinus officinalis*, *Ocimum basilicum*, *Becium filamentasum* and *Brassica nigra*.

Fragrant, stimulants and fodder plant species

A total of 12 species of fragrances, 3 stimulants and 4 fodder species were documented. The three use categories together consisted of 7.36% of the total useful plant species documented. The five most commonly used fragrant plant species in the majority of homegardens were *Olea europea*, *Cympogen citrates*, *Lippia adoensis*, *A.abysinthium*, and *A. abyssinica*.

Timber (furniture) plants

Timber plant species constitute 29 plant species which accounted 11.4% of all plant species documented. Timber species which occurred in more than 50% of the homegarden namely *Melia azedarch*, *Grevillea robusta*, *Cupressus lstantica*, *Cordia africana*, *Casuarina equisetifolia*, *Acacia melanoxylon*. Among 29 plant species recorded 17 were indigenous plants which were highly treated in the forest namely *Prunus africana*, *Hagenia abyssinica*, *Juniperus procera*, *Podocarpus falcatus*, *O. europea*, *Celtis africana*, and *Aningeria adolfi friedericii* (Appendix IV and V).

The highest Shannon-Wiener Diversity Index (H') of useful plant species was recorded for Tabor sub city (H' = 5.87) followed by Haik dar subcity (H' = 3.80) and the lowest diversity index was recorded at Menhara sub city (H' = 2.77) (Table 1).

Table 1. Shannon-Wiener Diversity Index (H') for seven study sites.

Study sites	Species richness	Shannon's index(H')
Haik dar	45	3.80
Tabor	48	3.87
Misrak	35	3.55
Addis ketema	30	3.40
Bahladrash	27	3.29
Mehal ketema	28	3.33
Menhara	16	2.77

Table 2. Jaccard's similarity coefficient for comparing homegardens number of plant species composition in the homegardens of Hawassa City with other areas of Ethiopia.

Study site	Sabata town	Holeta town	Arba minch zuria	Sidama zone	Basketo and Kefa	Gedeo zone	Wolayta zone	Selected areas of Amhara
Total number of species	135	112	133	198	224	165	159	85
Common species	120	106	70	120	50	130	58	30
JSC	0.465	0.421	0.272	0.44	0.12	0.443	0.22	0.096
Percentage similarity	46.5	42.1	27.2	44	12	44.3	22	9.6
Source	Habtamu and Zemed (2011)	Mekonen et al. (2014)	Belachew et al. (2006)	Tesfaye (2005)	Feleke (2011)	Solomon (2011)	Talemos et al. (2013)	Fentahun (2008)

The highest values of Jaccard's Coefficient of Similarity index (JCS) indicate a higher similarity in homegarden species diversity. The JCS result indicates that homegardens of Hawassa city was the highest similarity with homegarden composition of Sabata town (JCS = 0.46), Gedeo zone (JCS = 0.43) and Sidama zone (JCS = 0.44). Home gardens of selected areas of Amhara (JCS = 0.096), Basketo and Kefa (JCS = 0.12) and Wolayta (0.22) showed the weakest similarity coefficient (Table 2).

Contribution of urban homegarden to household food security

In Hawassa city, the role of homegarden for cash income generation and household consumption was highly increased particularly in Haikidar sub-city, while it is decreased at the center of the city. The ornamental function of home gardens increased particularly in the center of the city, where 50% of the gardeners mentioned decoration as the main function of their gardens in the study survey. About 40% of the respondents report that home garden is a source of their income. Ten percent of them reply that homegarden is a supplementary source of their income and 50% use homegarden as a place of enjoyment. Poverty and unemployment is high in Hawassa city, most youth rely on cultivation of ornamental plants to generate income by selling ornamental plants to support their families at road side of

the city. About 75% of the homegardeners explained that they conserve useful plant species for foods, 10% for income generation, 25% for pleasure, 25% for medicinal use, 15% for construction and other livelihood needs. The study showed that the majority of homegardeners are under food insecurity especially the poor urban dwellers. Food security assessment survey indicates that 25% of the homegardeners were found food secured throughout the year, 15% of the gardeners are food secured only for six months. The poor homegardeners attained food security through production in their own garden but the reach homegardeners purchase from local market.

The homegardens contributions to household's annual income was 35% of the total income, among which 20% from food plants, 10% from ornamental plants, 0.5% from medicinal plants and 4.5% from others (Figure 4). *Araucaria heterophylla* is the most expensive ornamental plant species sold in the market. One plant of *A. heterophylla* is sold at 500 to 1500 ETB (\$24 to 72). *Terminalia mentalis* is the second expensive ornamental plant sold. One plant species of *T. mentalis* is sold as up to 250 to 500 ETB (\$12 to 24). Medicinal plants are no direct income to households. Poor urban women are preparing *E. ventricosum* corm kocho for food security (Figure 5).

Only a few homegardeners has sufficient food for a year. The homegardens in the Hawassa city only contributes 10% fresh vegetables. Livestock and poultry farming in the homegardens also another source of

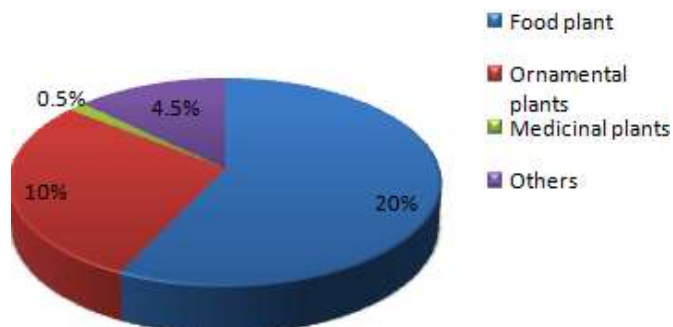


Figure 4. Percentage of contribution of categories to the total income earned from food, ornamental, medicinal and other use categories.



Figure 5. Women pulverizing *Ensete ventricosum* corm in Kocho preparation for food security in Hawassa city home garden near Haikdar.

income generation contributes 15%, cow milk (10%), poultry (15%), pig (0.5%) chickens (5%), ducks (0.5%). *Sugar cane* (*S. officinarum*), *Kocho* (*E. ventricosum*), *Muzi* (*M. paradisiaca*) accounted for about 35% of the homegardens income contribution. Income from homegarden increases an average household income from 1177 to 4580 Birr.

Preference ranking of top ten useful food plant species by home gardeners for household income generation shows that *M. paradisiaca* is the most preferable food crops in the first rank with a score of 120 with maximum yearly income generation of 15000 Ethiopian Birr (ETB), *S. officinarum* is the second with a score of 117 with yearly income generation of 10000 ETB and *E. ventricosum* and *Zea mays* are the third and fourth places with income generation of 6000 and 5500 ETB respectively (Table 3).

The categories of use identified are ornamental,

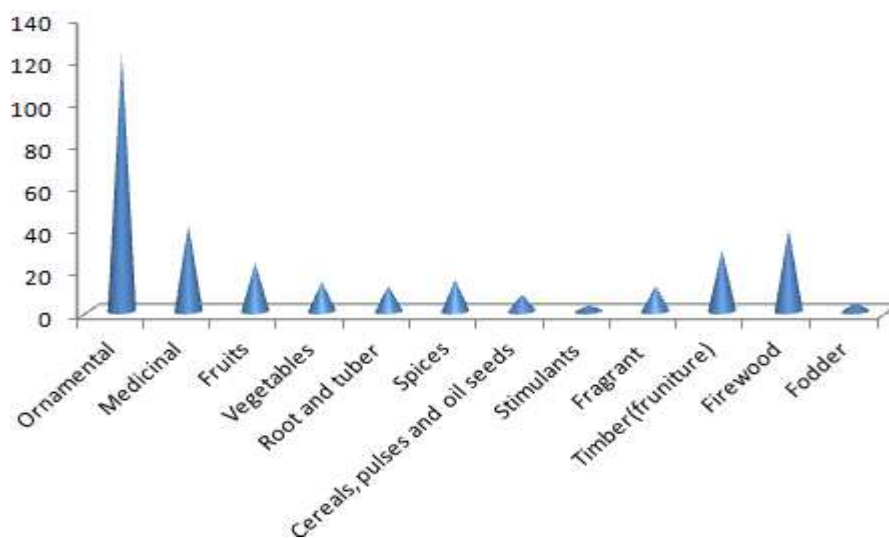
medicine, food, firewood, timber, construction, fodder, spices, fragrant and others. A total of 71 species are reported as having one use type, 103 species having two use types and 86 species with three use types. The most numerous species were ornamental 122 species followed by food crops, medicinal plants, fuel wood and constructions (Figure 6).

Gender role in the homegarden management

The management of homegardens includes tree planting, watering, weeding and fencing. The homegardeners maintain their homegarden soil fertility by using animal manure and leaf litter. Both men and women are involved in the management of homegardens. Mostly the old aged people are spent most of their time in the management of homegardens in the Hawassa city.

Table 3. Top ten ranking food crops of HG as determined by preference ranking with income generation.

S/N	Household use rank			Yearly income generation(ETB)		
	Scientific name	Total score	Rank	minimum	maximum	Rank
1	<i>Lactuca sativa</i>	99	9 th	500	2500	5 th
2	<i>Brassica rapa</i>	84	4 th	300	2000	6 th
3	<i>Musa x paradisiaca</i>	120	5 th	5000	15000	1 st
4	<i>Saccharum officinarum</i>	117	3 rd	1000	10000	2 nd
5	<i>Ensete ventricosum</i>	114	2 nd	1500	6000	3 rd
6	<i>Persea americana</i>	80	6 th	250	900	7 th
7	<i>Carica papaya</i>	79	10 th	200	850	8 th
8	<i>Mangifera indica</i>	69	8 th	370	600	9 th
9	<i>Zea mays</i>	110	1 st	2500	5500	4 th
10	<i>Dioscorea sagittifolia</i>	55	7 th	150	450	10 th

**Figure 6.** Categories of uses identified in the homegardens of Hawassa city.

Females managed 47% of useful plant species diversity by planting, watering, weeding and selling while males managed 53% by cultivation of food crops, ornamental, medicinal plants, fencing, digging, designing, searching seeds and other useful plants (Figure 7).

Most youth participated in the cultivation of ornamental plants near road side of the city for income generation (Figure 8).

Constraints of homegardens in Hawassa city

According to the semi structured interview report the main constraints of homegardens of the study area were knowledge gap in plant breeding (66.7%), lack of planting materials and seeds (63.3%), lack of agricultural support system (57.5%), and lack of awareness (55%) respectively (Table 4).

The main source of planting materials in the study homegardens are market (45%), cultivating in their homegardens (20.83%) and from relatives (16.67%). Agricultural office, local and international NGOs are the least source of planting materials (Table 5).

DISCUSSION

A total of 258 species (64 trees, 70 shrubs, 115 herbs and 16 climbers) belonging to 186 genera under 76 family were documented. In Hawassa city, more than 50 ethnic groups are living which have different language, culture, custom, beliefs and religion. Cultural diversity in Hawassa city helps to conserve useful plant species biodiversity in homegardens. Different ethnicity, culture and religion make a unique plant species diversity in the homegardens of Hawassa city (Reta, 2013). Sthapit et al.



Figure 7. The role of Men and Women in the management of Home garden in Hawassa.



Figure 8. One of the youth selling ornamental plants at the road side in Hawassa city.

Table 4. Challenges of homegarden with percentage distribution with frequency (n = 120).

Challenges	Frequency	Percentage	Rank
Knowledge gap in plant breeding	80	66.66	1
Lack of planting materials & seeds	76	63.3	2
Lack of agricultural support system	69	57.5	3
Lack of awareness	66	55	4
Water lodging during winter season	45	37.5	5
Lack of water availability	35	29.17	6
Destruction by animals	21	17.5	7
Disease infestation	20	6.66	9
Lack of access to land (Size of home garden)	18	15	8

Table 5. Source of plant materials in the homegardens of Hawassa city.

Source	No. of respondents	Percentage
Market	54	45.0
Relatives	20	16.67
Neighbors	10	8.33
Cultivate in their homegarden	25	20.83
Agricultural office	6	5.0
NGOs	5	4.17

(2004) showed that the composition of unique plants in homegardens varies with ethnicity, food culture, religion and spirituality. The total numbers of species recorded in the homegardens of Hawassa city are greater than number of species reported from other parts of Ethiopia. For example, Feleke (2011) reported 224 plant species from homegardens of Basketo and Kafa, Sothern Ethiopia; Mathewos et al. (2013) reported 214 plant species from homegardens of Dwaro zone, southern Ethiopia; Tesfaye (2005) reported 198 plant species from homegardens of Sidama, Southen Ethiopia; Solomon (2011) reported 165 plant species from Gedeo zone. The present study reported 72(27.9%) of food plant species from the total record of 258 useful plants species from homegardens of Hawassa city. Zemede (1997) reported about 126 (75% of the total record) plant species used as food from Ethiopian homegardens. Moreover, Belachew et al. (2003) and Habtamu (2008) reported 48 and 37 edible plant species from homegardens of Arbaminch and Sebeta areas respectively. Solomon (2011) identified about 68 plant species used as food from homegarden areas in Kochere Wereda. Feleke (2011) and Mathewos et al (2013) reported 102 and 77 food plants from homegardens of Basketo and Dwaro zone, respectively.

Urban homegardens are sources of food crops, vegetables, cereals, pulses, fruits, spice, milk and livestock etc. Therefore, it is important contributors to household food security of poor urban dwellers and the rich ones also. Urban homegardening is one of the best methods for food production which feed high population, as food security is a major concern in many parts of the world and in many of urban and rural areas of Ethiopia. Urban home garden is a future promising agricultural activity that reduces urban food insecurity. In Ethiopia, cities are not practicing urban agriculture even though there are enough free spaces in and around city gardeners. Mohammed (2002) reported that Ethiopia is the country where existence and significant contribution of urban agriculture was not only disregarded and unrecognized by researchers but also underestimated and given very little attention by urban development studies. Limited homegarden size available for gardeners make them to grow different homegarden species. In the present study the majority of home gardens even though they have large home garden size, they contain low

number of species diversity due to lack of knowledge gaps on cultivation, management and conservation of useful plant species.

The total number of species in a single homegarden was found to be a maximum of 45 with more than 85% households having the species numbers up to 10 to 45. The highest number of species was highest in the Haikdar sub-city and Tabor sub-city respectively (45 and 35 species) because there is sufficient irrigation water and large garden size in Hayikdar sub city and large home garden size in Tabor sub-city. The home gardens was the richest as more than 60% of the home gardens had more than 30% species per homegarden and Bahladarash, Mehalketema, Menaheria sub cities are the poorest species diversity where more than 65% homegardens had less than 20 species in home garden. In Ethiopia, there are very few studies on useful plant species diversity and its contribution to food security in urban homegardens. Many studies on home gardening and plant diversity have concentrated on rural areas (Das and Das, 2005). There are very few systematic studies on domestic garden diversity in urban or sub urban areas (Smith et al., 2005). Urban homegardening ensures households food security by providing vegetables, fruits, medicinal plants, fuel wood, ornamental plants, fodders, construction materials, root and tubers. About 25% of the respondents reported that annually they earned a high income of 10,000 and 25,000 ETB from selling various products of useful plant species.

The most useful plant species cultivated in the home gardens of Hawassa city were ornamental plants (47.29%) and food plants (27.91%). Ornamental plant species are the most diversified, abundant and species rich use category. Similar study was report from homegardens of Tlhakgameng in which 57% were ornamental plants and 27% were food plants (Molebatsi, 2011). Cilliers (2010) also reported 28% of food plants in Ganyesa home gardens. This shows that most poor peoples in urban areas are largely dependent on cultivation of ornamental plants for aesthetic value, selling to sustain their livelihood and food plants for consumption purposes.

According to Nair (1993), the high number of ornamental plants is associated with the aesthetic role of home gardens in cities, since they are not used for

subsistence in urban areas except among low income populations (Ninez, 1984). The number of ornamental plants has increased in areas near, as well as in urban areas in response to the process of modernization and the large supply of these plants in cities (Moura and Andrade, 2007).

The major contributor to diversity of urban environments is horticultural floras which are mostly characterized by ornamental plants and vegetables (Gaston et al., 2005, Marco et al., 2008). The most cultivated crops in the homegarden were *E. ventricosum*, *C. papaya*, *P. americana*, *C. arabica*, *M. paradisica*, *P. guajava* and *M. indica*. *Zea mays* was the most widely used cereal crops in the homegardens of Hawassa city as it occurred in 85% of sampled households.

Within home garden the number of species per homegarden ranged from 10 to 45 and the mean was 21. Similar research reports on the number of species in home garden of different areas by different researchers for instance, Kabir and Webb (2009) reported 419 species of plants with an average of 34 species per household across 402 homegardens from Bangladesh. Mendez et al (2001) reported a total of 324 species with nine different uses from Nicaragua with an average of 70 species perhomegarden. Tynsong and Tiulari (2010) reported 197 plant species with an average of 89 plant species per homegarden average size of 750 m². Tesfaye et al. (2010) reported 78 cultivated crops within 44 homegardens from Sidama southern Ethiopia with 16 as an average number of species per farms. Mekonnen et al. (2014) reported 112 plant species in the homegardens of Holeta town with the mean of 22 species perhomegarden.

Olajide-Taiwe et al. (2010) reported 36 plant species in homegarden from Ibadan, Oyo state. The total number of species and average number of species per homegarden in the present study was less compared to the previous report. Fabaceae had the highest number of species recorded in the homegardens study.

The dominance of Fabaceae was reported from other homegarden studies in Ethiopia (Tefera, 2010; Mekonnen et al., 2014). This may indicate that homegardeners mostly cultivated Fabaceae for food security purposes.

The present study agrees with many previous researches finding on significance of homegarden to household food security. For examples, Olajide-Taiwode et al. (2010) reported 36 plant species from Ibadan, Oyo state showed that homegardening increased family supply. Maroyi (2009) reported 69 plant species from Nhema, Zimbabwe indicated homegarden as important for poor households to overcome adversity and meet basic needs. Tynsong and Tiwari (2010) finding from Meghalaya, India showed that homegarden contributed 7% of the total household income.

Tesfaye (2005) found that richness is positively related with household income, evenness of species is low in homegarden owned by rich household compared to that

of poorer households. Kumari (2009) has argued that the higher the household expenses, the higher the food plant density and the lower the total plant diversity. The same author has observed that rich households in urban areas tend to plant more ornamental plants with higher economic values in their home gardens (Kumari, 2009).

Conclusion

The homegardens of the study area is home for many useful plant species diversity. These useful plant species are a great value for household income generation, food security, medicinal, ornamental, and other non food livelihood needs of poor urban dwellers. The present study indicates that high useful plant species diversity documented in the homegardens of Hawassa city was associated with diversity of ethnicity with different language, culture, custom and beliefs. In addition to this, Hawassa city is the fastest growing city in Ethiopia. This also have eminent contribution to high useful plant species diversity in the area. The poor urban dwellers are highly interested in homegarden activities to sustain their livelihoods. The number of ornamental plant species diversity in the study area is higher. This shows that urban homegardeners gave more priority for ornamental plant cultivation for aesthetic value. The rich people have not shown much interest in the cultivation of food crops even though they have large homegarden size. The rich people gave more priority for conservation and management of ornamental plant species while the poor urban dwellers gave more priority for conservation and management of food crops to sustain their livelihoods. Proper management of homegardens has a great potential for biodiversity conservation, improving food security and provides contribution for ecosystem services in the study area. The present study indicates that there is a knowledge gap in the cultivation, conservation and management of useful plant species in the homegardens. Therefore, incorporating indigenous knowledge with scientific management and conservation of useful plant species, creating awareness among urban dwellers, will promote urban agriculture in Ethiopia in general and Hawassa city in particular.

Conflict of Interests

The authors have not declared any conflict of interests.

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Appendix I. List of ornamental plants, their local name, family, status, duration and frequency of occurrence (n=120).

No.	Scientific name	Family	Local name	Habit	Fr.	Status	Duration
1	<i>Acacia melanoxylon</i> R.Br.	Fabaceae	Omedlla(A)mh	Tree	67	C	P
2	<i>Acalypha wilkesiana</i> Mull. Arg.	Euphorbiaceae	Abeba	Shrub	23	C	P
3	<i>Achillea millefolium</i> L.	Asteraceae	Abeba	Herb	12	C	P
4	<i>Agave americana</i> L.	Agavaceae		Shrub	14	C	P
5	<i>Agave americana</i> var <i>marginata</i>	Agavaceae		Shrub	25	C	P
6	<i>Alcea rosea</i> L.	Malvaceae	Abeba	Herb	45	C	P
7	<i>Aloe vera</i> L.	Aloaceae	Argisaa	Herb	8	C	P
8	<i>Aloe gilbertii</i> Reynolds	Aloaceae	Argisaa	Herb	7	C	P
9	<i>Alocasia macrorrhizos</i> (L.)G.Don	Araceae	Elephant ears	Herb	29	C	p
10	<i>Araucaria heterophylla</i> (Salisb.)Franco	Araucariaceae	Yeferejitid	Tree	10	C	P
11	<i>Arundinaria alpina</i> K. Schum.	Poaceae	Kerkeha	shrub	5	C	P
12	<i>Asparagus setaceus</i> (Kunth) Jessop	Asparagaceae	Seriti	Cl	13	C	P
13	<i>Asparagus africanus</i>	Asparagaceae	Seriti	Cl	15	C	P
14	<i>Azadirachta indica</i> A.Juss.	Meliaceae	Neem	Tree	6	C	P
15	<i>Bougainvillea glabra</i> Choisy	Nyctaginaceae	Bugambe	Shrub	24	C	P
16	<i>Bougainvillea spectabilis</i> Willd.	Nyctaginaceae	Bugambe	Shrub	20	C	P
17	<i>Brugmansia x candida</i> Pers.(Pro.sp)	Solanaceae	Angel's trumpets	Shrub	18	C	P
18	<i>Calathea zebrina</i> (Sims)Lindl	Marantaceae		Herb	36	C	P
19	<i>Callistemon citrinus</i> (Curtis) Seekls	Myrtaceae	Bottle brush	Tree	47	C	P
20	<i>Canna indica</i> L.	Cannaceae	Siet-akuri	Herb	35	C	P
21	<i>Canna x generalis</i> L. H. Bailey	Cannaceae	Enset abeba	Herb	10	C	P
22	<i>Chrysanthemum coronarium</i> L.	Asteraceae	Abeba	Herb	43	C	A
23	<i>Casuarina equisetifolia</i> L.	Casuarinaceae	Shewshewe	Tree	76	C	P
24	<i>Casuarina cunninghamiana</i>	Casuarinaceae	Shewshewe	Tree		C	P
25	<i>Catharanthus roseus</i> (L.)G.Don	Apocynaceae	Abeba	Herb	37	C	A/P
26	<i>Ceiba pentandra</i> (L.) Gaertn	Bombacaceae		Tree	8	C	P
27	<i>Centella asiatica</i> (L.) Urb.	Apiaceae		Herb		C	P
28	<i>Clerodendrum myricoides</i> (Hochst.) Vatke.	Lamiaceae		Herb	6	C	P
29	<i>Codiaeum variegatum</i> (L.)A.Juss.	Euphorbiaceae	Masincho	Shrub	22	C	P
30	<i>Codiaeum</i> spp.	Euphorbiaceae	Masincho	Shrub	21	C	P
31	<i>Combretum collinum</i> Fresen	Combretaceae		Tree	5	W/C	P
32	<i>Cordyline terminalis</i>	Agavaceae		Herb 26		C	P
33	<i>Cosmos bipinnatus</i> Cav	Asteraceae	Abeba	Herb	7	C	P
34	<i>Crassula schimper</i> Fisch. & Mey.	Crasulaceae	Abeba	Herb	13	C	P
35	<i>Croton gratissimus</i> Burch.	Euphorbiaceae	Masincho ferenje	Shrub	21	C	P
36	<i>Cupressus lusitanica</i> Mill.	Cupressaceae	Homme	Tree	74	C	P

Appendix I. Contd.

37	<i>Cyperus bulbosus</i> Vahl	Cyperaceae	Kunti	Herb	11	C	P
38	<i>Cyperus rotundus</i> L.	Cyperaceae		Herb		C	P
39	<i>Dahlia pinnata</i> Cav.	Asteraceae	Abeba	Herb	10	C	P
40	<i>Datura metel</i> L.	Solanaceae		Herb	5	C	A/P
41	<i>Delonix regia</i> (Boj.ex Hook.)Ref.	Fabaceae	Yedirezaf	Tree	38	C	P
42	<i>Dianthus caryophyllus</i> L.	Caryophyllaceae	Abeba	H	9	C	P
43	<i>Dracaena afromontana</i>	Dracaenaceae	Abeba	Tree	5	C	P
44	<i>Dracaena steudneri</i> Engl.	Dracaenaceae	Lanticho	Tree	28	C	P
45	<i>Dracena sanderia</i>	Dracaenaceae	Happy plant	Herb	47	C	P
46	<i>Duranta erecta</i> L.	Verbenaceae	Sky flower	Shrub	49	C	P
47	<i>Duranta erecta aureo-variegata</i>	Verbenaceae		Shrub	20	C	P
48	<i>Duranta repens</i> L.	Verbenaceae		Shrub	48	C	P
49	<i>Duranta repens</i> Linn.var.variegata	Verbenaceae		Shrub	44	C	P
50	<i>Epipremnum aureum</i> (L.)Engl.	Araceae		Cl	3	C	P
51	<i>Euphorbia antiquorum</i> L.	Euphorbiaceae		Herb	6	C	P
52	<i>Euphorbia cotinifolia</i> L.	Euphorbiaceae	Duumo daraaro	Shrub	15	C	P
53	<i>Euphorbia baioensis</i> S.Carter	Euphorbiaceae		Herb		C	P
54	<i>Euphorbia griffithii</i> Hook.F.	Euphorbiaceae		Shrub	9	C	P
55	<i>Euphorbia myrsinites</i> L.	Euphorbiaceae		Herb	13	C	P
56	<i>Euphorbia pulcherrima</i> (R.Grah.)Wild.	Euphorbiaceae	daraaro	Shrub	12	C	P
57	<i>Euphorbia milii</i> (Bojerex Hook.)Ursch & Leandri	Euphorbiaceae	Ye'akilil eshoh	Shrub	8	C	P
58	<i>Ficus benjamina</i> L.	Moraceae	Ornamental fig	Shrub	5	C	P
59	<i>Ficus elastica</i> Roxb.	Moraceae	Yegoma zaf	Tree	6	C	P
60	<i>Gazania rigens</i> var. <i>rigens</i> (L)Gaertn. var. <i>uniflora</i> (L.f.) Roessler	Asteraceae	Abeba	Herb	7	C	P
61	<i>Grevillea robusta</i> R.Br.	Proteaceae	Temenjazaf	Tree	39	C	P
62	<i>Hibiscus acetosella</i> Welw. ex Hiern	Malvaceae	Abeba	Shrub	11	C	P
63	<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	Abeba	Shrub	18	C	P
64	<i>Hibiscus</i> sp.	Malvaceae	Abeba	Shrub	23	C	P
65	<i>Hippeastrum puniceum</i> (Lam.) Kuntze	Amaryllidaceae		Herb	10	C	P
66	<i>Hypericum revolutum</i> Vahl	Hypericaceae	Garaanbicho	Shrub	2	C	P
67	<i>Indigofera spicata</i> Forssk.Var.spicata	Fabaceae	Abeba	Herb	6	C	P
68	<i>Ipomoea purpurea</i> (L.)Roth	Convolvulaceae	Abeba	Cl	9	C	P
69	<i>Iresine herbstii</i> Hook.ex Lindl.	Amaranthaceae	Abeba	Herb	39	C	P
70	<i>Jacaranda mimosifolia</i> D.Don.	Bignoniaceae	Jacaranda	Tree	78	C	P
71	<i>Juniperus procera</i> HochstexEngl.	Cupresaceae	Honcho	Tree	12	C	P
72	<i>Kalanchoe lanceolata</i> (Forssk.)Perr.	Crassulaceae	Hanculuulle	Herb	5	C	P
73	<i>Lantana camara</i> L.	Verbenaceae	Yewofkolo	Shrub	25	C/W	P

Appendix I. Contd.

74	<i>Matteuccia struthiopteris</i> (L.)Todaro	Dryopteridaceae	Ferns	Herb	45	C	P
75	<i>Melia azedarch</i> L.	Meliaceae	Neem	Tree	99	C	P
76	<i>Mirabilis jalapa</i> L.	Nyctaginaceae	Abeba	Herb	39	C	P
77	<i>Nephrolepis cordifolia</i> (L.)Presl	Polypodiaceae	Farnii	Herb	65	C	P
78	<i>Nerium oleander</i> L.	Apocynaceae		Shrub	81	C	P
79	<i>Oenothera biennis</i> L.	Onagraceae		Herb	5	C	B
80	<i>Olea europaea</i> L.ssp. <i>Cuspidata</i> (Wall.ex G.Don) Cif.	Oleaceae	Ejersu	Tree	37	C	P
81	<i>Passiflora caerulea</i> L.	Passifloraceae		Cl	7	C	P
82	<i>Phalaris arundinaceae</i> L.	Poaceae		Herb	12	C	P
83	<i>Phoenix reclinata</i> Jacq.	Arecaceae	Saticho	Tree	40	C	P
84	<i>Pavonia urens</i> Cav.	Malvaceae	Abeba	Herb	6	C	P
85	<i>Pelargonium x hortorum</i> L.H.Bail.	Geraniaceae	Abeba	Herb	12	C	P
86	<i>Pelargonium zonale</i> (L.)L'He'r. ex Aiton	Geraniaceae	Abeba	H	13	C	P
87	<i>Pinus patula</i> L.	Pinaceae	Patula	Tree	18	C	P
88	<i>Pinus radiata</i> L	Pinaceae		Tree	13	C	P
89	<i>Plumbago auriculata</i> Lam.	Plumbagnaceae	Abeba	Shrub	5	C	P
90	<i>Plumeria alba</i> L.	Apocynaceae	Plumera	Shrub	14	C	P
91	<i>Plumeria rubra</i> L.	Apocynaceae	lumeria	Shrub	15	C	P
92	<i>Pyrostegia venusta</i> (Ker Gawl.)Miers	Bignoniaceae	Flame vine	Cl	11	C	P
93	<i>Rosa richardii</i> Hart.	Rosaceae	Tsgereda	Shrub	49	C	P
94	<i>Salvia leucantha</i> Cav.	Lamiaceae	Abeba	Herb	10	C	P
95	<i>Salvia splendens</i> Sellow exRoem.& Schult.	Lamiaceae	Abeba	Herb	7	C	P
96	<i>Scadoxus multiflorus</i> (Martyn)Raf.	Amarvllidaceae	Arfaasa	Herb	2	C	P
97	<i>Sanseveria trifasciata</i> var. <i>laurentii</i> (DeWild.)	Asparagaceae		Herb	37	C	P
98	<i>Sanseveria trifasciata</i> Prain.	Asparagaceae	Mother low's tongue	Herb	38	C	P
99	<i>Schefflera arboricola</i> (Hayata) Merr.	Araliaceae	Umberella tree	Shrub	10	C	P
100	<i>Schinus molle</i> L.	Anacardiaceae	Kundeberbere	Tree	12	C	P
101	<i>Senna siamea</i> (Lam.)H.S.Irwin &Barneby	Caesalpiniaceae	Siamese cassia	Shrub	13	C	P
102	<i>Senna spectabilis</i> (Dc.)Irwin & Barneby	Caesalpiniaceae		Shrub	18	C	P
103	<i>Sisyrinchium californicum</i> KerGawler)Dryander	Iridaceae	Yellow eyed grass	Herb	16	C	P
104	<i>Solenostemon scutellarioides</i> (L.)Codd	Lamiaceae	Painted nettle Coleus	Herb	49	C	P
105	<i>Spathodea campanulata</i> P.Beauv. ssp. <i>nilotica</i> .	Bignoniaceae		Tree	8	C	P
106	<i>Tagetes erecta</i> L.	Asteraceae		Herb	13	C	P
107	<i>Tagetes minuta</i> L.	Asteraceae		Herb	11	C	P
108	<i>Tagetes patula</i> L.	Asteraceae		Herb	9	C	P
109	<i>Tecoma capensis</i> (Thunb.) Spach	Bignoniaceae		Shrub	6	C	P
110	<i>Tecoma stans</i> (L.) Juss ex kunth	Bignoniaceae		Shrub	8	C	P

Appendix I. Contd.

111	<i>Terminalia mentalis</i> (T.Mantaly)	Combretaceae		Tree	39	C	P
112	<i>Thuja orientalis</i> L.	Cupresaceae		Tree	11	C	P
113	<i>Thevetia peruviana</i> Luckey Nut(Eng.)	Apocynaceae		Shrub	16	C	P
114	<i>Tradescantia pallida</i> (Rose)D.R.Hunt.	Commelinaceae		Herb	13	C	P
115	<i>Tradescantia zebrina</i> Bosse	Commelinaceae		Herb cclent	19	C	A/P
116	<i>Tradescantia spathacea</i> Sw.	Commelinaceae		Herb	13	C	P
117	<i>Tropaeolum majus</i> L.	Tropaeolaceae		Herb	8	C	A/P
118	<i>Vinca minor</i> L.	Apocynaceae	Abeba	Herb	17	C	P
119	<i>Vitis vinifera</i> L.	Vitaceae		Liana	5	C	P
120	<i>Washigtonia robusta</i> (Lindl.) H.Wendl.	Arecaceae	Saticho	Tree	21	C	P
121	<i>Zamioculcas zamiifolia</i> (Lodd.et al)Engl.	Araceae		Shrub	10	C	P
122	<i>Zephyranthes candida</i> (Lindi.)Her.	Amaryllidaceae		Herb	7	C	P

Appendix II. List of food plant species documented in Hawassa city homegardens.

No.	Vegetables	Scientific name	Family	Local name	Habit	Fr.	Status	Parts Used	Duration
1		<i>Allium sativum</i> L.	Alliaceae	Nechishinkurt	H	8	C	Bulb	P
2		<i>Allium cepa</i> L.	Alliaceae	Keyishnkurt	H	15	C	Bulb	P
3		<i>Amaranthus hybridus</i> L.	Amaranthaceae		H	11	W/C	Leaves	A
4		<i>Brassica carinata</i> A.Br.	Brassicaceae	Gomen	H	49	C	Leaves	A
5		<i>Brassica integrifolia</i> L.	Brassicaceae	Yeguragegomen	H	51	C	Leaves	A
6		<i>Brassica oleracea</i> L.	Brassicaceae	Tiklegomen	H	45	C	Leaves	P
7		<i>Brassica oleracea</i> L.var.capitata	Brassicaceae	Tiklegomen	H	32	C	Leaves	P
8		<i>Beta vulgaris</i> L.	Brassicaceae	Kosta	H	39	C	Leaves	A
9		<i>Lycopersicon esculentum</i> Mill.	Solanaceae	Timaatim	H	67	C	Fruits	A
10		<i>Lactuca sativa</i> L.	Asteraceae	Selata	H	78	C	Leaves	A
11		<i>Saccharum officinarum</i> L.	Poaceae	Shonkora	H	81	C	Stem	P
12		<i>Solanum nigrum</i> L.	Solanaceae	Tunayee	H	49	W/C	Leaves	A
13		<i>Solanum melongena</i> L.	Solanaceae	Sarajan/eggplant	H	23	C	Fruits	P
14		<i>Moringa stenopetala</i>	Moringinaceae	Shifera/Halako	T	56	C	Leaves	P
15		<i>Solanum tuberosum</i> L.	Solanaceae	Dinichi	H	21	C	Leaves	A
Root Crops									
1		<i>Beta vulgaris</i> L.	Chenopodiacea	Keysir	H	78	C	Root	B
2		<i>Colocasia esculenta</i> (L.)Schott	Araceae	Godare	H	90	C	Root	A
3		<i>Dacus carota</i> L.	Apiaceae	Karot	H	25	C	Root	B

Appendix II. Contd.

4	<i>Dioscorea alata</i> L.	Dioscoreaceae	Boyna	Cl	59	C	Root	A
5	<i>Dioscorea bulbifera</i> L.	Dioscoreaceae	Kotehare	Cl	22	C	Root	A
6	<i>Dioscorea sagittifolia</i> Pax.	Dioscoreaceae	Keyi bohina	Cl	43	C	Root	A
7	<i>Dioscorea praehensilis</i> Benth	Dioscoreaceae	Nechi bohina	Cl	42	C	Root	A
8	<i>Ensete ventricosum</i> (Welw.) Cheesman	Musaceae	Wesse	Sh	117	C	Root	P
9	<i>Ipomoea batatas</i> (L.) Lam.	Convolvulaceae	Maxaxisha	H	54	C	Root	A
10	<i>Manihot esculenta</i> Crantz	Euphorbiaceae	Cassava	Sh	29	C	Root	A
11	<i>Solanum tuberosum</i> L.	Solanaceae	Dinich	H	21	C	Stem	A
12	<i>Xanthosoma sagittifolium</i> (L.) Schott	Araceae	Tikur godare	H	73	C	Root	A
Fruit crops								
1	<i>Ananas comosus</i> (L.) Merr.	Bromeliaceae	Ananas	Herb	2	C	Fruit	P
2	<i>Annona squamosa</i> L.	Annonaceae	Gishta	Tree	70	C	Fruit	P
3	<i>Carica papaya</i> L.	Caricaceae	Papaya	Tree	97	C	Fruit	P
4	<i>Casimiroa edulis</i> Laliave	Rutaceae	Kasmir	Tree	89	C	Fruit	P
5	<i>Citrus aurantium</i> L.	Rutaceae	Komtate	Sh	69	C	Fruit	P
6	<i>Citrus medica</i> L.	Rutaceae	Tirengo	Sh	25	C	Fruit	P
7	<i>Citrus aurantifolia</i> (Christm.) Swingle	Rutaceae	Lomi	Sh	19	C	Fruit	P
8	<i>Citrus sinensis</i> (L.) Osb.	Rutaceae	Birtukan	Sh	16	C	Fruit	P
9	<i>Cucurbita pepo</i> L.	Cucurbitaceae	Duba	Cl	59	C	Fruit	A
10	<i>Balanites aegyptica</i>	Balanitaceae	Badana	Tree	21	W	Fruit	P
11	<i>Dovyalis caffra</i> (Hook.f.&Harv.)	Flacaurtiaceae	Koshim	T	49	W	Fruit	P
12	<i>Ficus sur</i>	Moraceae	Shola	T	18	W	Fruit	P
13	<i>Mangifera indica</i> L.	Anacardiaceae	Mango	T	98	C	Fruit	P
14	<i>Malus sylvestris</i> Mill.	Rosaceae	Apple	T	24	C	Fruit	P
15	<i>Morus alba</i> L.	Moraceae	Gora	T	19	C	Fruit	P
16	<i>Musa x paradisiacal</i> L.	Musaceae	Muzi	Sh	99	C	Fruit	P
17	<i>Passiflora edulis</i> Sims.	Passifloraceae	Hopi	Cl	11	C	Fruit	P
18	<i>Persea americana</i> Mill.	Lauraceae	Avocado	T	98	C	Fruit	P
19	<i>Prunus x domestica</i> L.	Rutaceae	Prim	T	2	C	Fruit	P
20	<i>Prunus persica</i> (L.) Batsch.	Rosaceae	Kok	T	9	C	Fruit	P
21	<i>Psidium guajava</i> L.	Myrtaceae	Zeyitun	T	97	C	Fruit	P
22	<i>Punica granatum</i> L.	Punicaceae	Roman	Sh	30	C	Fruit	P
23	<i>Syzygium guineense</i> (Willd.) Dc	Myrtaceae	Dokima	T	2	W	Fruit	P
Cereal, pulses and oil crops								
1	<i>Cajanus cajan</i> (L.) Mill.	Fabaceae	Yewof ater	Shrub	20	C	Seeds	P
2	<i>Canavalia africana</i> L.	Fabaceae	Adengware	Herb	54	C	Seeds	A
3	<i>Carthamus tinctorius</i> L.	Asteraceae	Suf	Shrub	43	C	Seeds	A

Appendix II. Contd.

4	<i>Jatropha curcas</i> L.	Euphorbiaceae	Jatroba	Shrub		14	C	Seeds	P
5	<i>Phaseolus vulgaris</i> L.	Fabaceae	Boloqqie	Climber		40	C	Seeds	A
6	<i>Phaseolus lunatus</i> L.	Fabaceae	Adengware	Climber		45	C	Seeds	A
7	<i>Ricinus communis</i> L.	Euphorbiaceae	Gulo	Shrub		52	C/W	Seeds	P
8	<i>Zea mays</i> L.	Poaceae	Badala	Herb		118		Seeds	A
List of spices									
1	<i>Allium sativum</i> L.	Alliaceae	Nechishnkurt	Herb	Bulb		16		P
2	<i>Allium cepa</i> L.	Alliaceae	Keyi shunkurt	Herb	Bulb		23		P
3	<i>Becium filamentosum</i> (Forssk.)Clab.	Lamiaceae		Herb	Fruit		5		B
4	<i>Brassica nigra</i> (L.)Koch	Brassicaceae	Sinafich	Herb	Seed		5		A
5	<i>Capsicum annuum</i> L.	Solanaceae	Miximixa	Herb	Fruit		14		A
6	<i>Capsicum frutescens</i> L.	Solanaceae	Berberie	Herb	Fruit		12		A
7	<i>Coriandrum sativum</i> L.	Apiaceae	Dinbilali	Herb	Fruit		52		A
8	<i>Lippia adoensis</i> var. <i>kosert</i> Sebsebe	Verbenaceae	Kosert	Shrub	Leaves		10		P
9	<i>Lippia adoensis</i>	Verbenaceae	Kasse	Shrub	Leaves		15		P
10	<i>Menta spicata</i> L.	Lamiaceae	Nana	Herb	Leaves		14		P
11	<i>Ocimum basilicum</i> L.	Lamiaceae	Besobila	Herb	Seeds, leaves		37		A
12	<i>Ocimum basilicum</i> var. <i>basilicum</i> L.	Lamiaceae	Besobila	Herb	Seeds, leaves		20		A
13	<i>Rhamnus prinoides</i> L'Herit	Rhamnaceae	Gesho	Shrub	Leaves, stem		6		P
14	<i>Rosmarinus officinalis</i> L.	Lamiaceae	Sigametbesha	Shrub	Leaves		68		P
15	<i>Ruta chalpensis</i> L.	Rutaceae	Sunkurta	Herb	Leaves and seed		79		P
16	<i>Zingiber officinale</i> L.	Zingiberaceae	Zingibel	Herb	Stem		2		P
List of stimulant species									
1	<i>Catha edulis</i> (vahl.)Forssk.ex.Endl.	Celastraceae	Chat	Shrub	Leaves		12		P
2	<i>Coffea arabica</i> L.	Rubiaceae	Buna	Shrub	Fruits		97		P
3	<i>Nicotiana tobacum</i> L.	Solanaceae	Timbaho	Herb	Leaves		13		A
List of fragrant plant species									
1	<i>Artemisia absinthium</i> L.	Asteraceae	Ariti	Herb	Leaves		5	C	P
2	<i>Artemisia abyssinica</i> L.	Asteraceae	Chuqun	Herb	Leaves		12	C	P
3	<i>Cympogen citrates</i> (DC.) Stapf.	poaceae	Hexicho	Herb	Leaves		29	C	P
4	<i>Faeniculum vulgare</i>	Apiaceae	Insilal	Herb	Leaves		11	C	B
5	<i>Lippia adoensis</i> var. <i>adoensis</i> Hochst.exWalp	Verbenaceae	Kessie	Shrub	Leaves		33	C	P
6	<i>Lippia adoensis</i> var. <i>koseret</i> Sebsebe	Verbenaceae	Kosert	Shrub	Leaves		45	C	P
7	<i>Myrtus communis</i> L.	Myrtaceae	Ades	Shrub	Leaves		4	C	P
8	<i>Ocimum lamiifolium</i> Hochst.ex Benth.	Lamiaceae	Demakase	Shrub	Leaves		89	C	P
9	<i>Otostogia integrifolia</i> Benth.	Lamiaceae	Tinjuit	Shrub	Leaves/stem		6	C	A
10	<i>Olea europea</i>	Oleaceae	Weira	Tree	Leaves/stem		23	C	P

Appendix II. Contd.

11	<i>Ruta chalepensis</i> L.	Rutaceae	Tena adam	Herb	Leaves	115	C	P
12	<i>Rosmarinus officinalis</i> L.	Lamiaceae	Siga metibesha	Shrub	Leaves	68	C	P
List of fodder species								
1	<i>Cynodon dactylon</i> (L.)Pers	Poaceae	Sardo	Herb	Leaves	37	W	P
2	<i>Pennisetum purpureum</i> Schumach	Poaceae	Elphant grass	Herb	Leaves	21	C	P
3	<i>Sesbania sesban</i> L. Merr	Fabaceae	Sesbania	Shrub	Seeds	26	C	P
4	<i>Vetiveria zizanioides</i> (Linn.)Nash	Gramineae	Vetiver grass	Herb	Leaves	13	C	P

Appendix III. List of medicinal plants documented in the Hawassa city homegardens.

No.	Scientific name	Family	Local name	Habit	Parts used	Disease treated	Fr.	Duration
1	<i>Achranthes aspera</i> L.	Amaranthaceae	Telnji	H	Root	Pneumonia	78	P
2	<i>Allium sativum</i> L.	Alliaceae	Nechshinkurt	H	Bulb	Malaria	14	P
3	<i>Aloe vera</i> (L.) Burm.f.	Aloaceae	Ret	H	Stem	Malaria, wound	18	P
4	<i>Azadiachta indica</i>	Meliaceae	Neem	T	Leaves	Malaria	12	P
5	<i>Artemisia abyssinica</i> L.	Asteraceae	Ariiti	H	Leaves	Evil eye, stomach ache	46	P
6	<i>Artemisia absinthium</i> L.	Asteraceae	Chkun	H	Leaves	Hemorrhoid	35	P
7	<i>Artemisia afra</i>	Asteraceae		H	Leaves	Evileye	40	P
8	<i>Carica papaya</i>	Caricaceae	Papaya	T	Leaves	Malaria	97	P
9	<i>Carissa edulis</i>	Apocynaceae	Agam	Sh	Stem	Eveil eye	5	P
10	<i>Cassia occidentalis</i> (L.)Link.	Fabaceae	Hamashaqa	H	Leaves	Body swelling	15	P
11	<i>Coffea arabica</i> L.	Rubiaceae	Bunna	Sh	Seeds	Gastric illness	98	P
12	<i>Commelina benghalensis</i> L.	Commelinaceae		H	Stem	Wound	42	A
13	<i>Croton macrostachyus</i>	Euphorbiaceae	Bisana	T	Leaves	Cancer	64	P
14	<i>Cucumis ficifolius</i> A.Rich	Cucurbitaceae	Yemed emboy	Cl	Leaves,fruits	Cold,heart disease	29	P
15	<i>Datura stramonium</i> L.	Solanaceae	Asangira	H	Leaves, seeds	Wound,	21	A
16	<i>Dodonaea angustifolia</i>	Sapindaceae	Ittancha	T	Stem	Tooth ace	5	P
17	<i>Eucalyptus globulus</i>	Myrtaceae	Nechi barzaf	T	Leaves	Common cold	3	P
18	<i>Euphorbia tirucalli</i>	Euphorbiaceae	Qincib	Sh	Stem fluid	Hemorrhoid	15	P
19	<i>Foeniculum vulgare</i>	Apiaceae	Insilal	H	Leaves	Stomach pain, urine problem	6	B
20	<i>Hagenia abyssinica</i>	Rosaceae	Kosso	T	Flowers	Tape worm	9	P
21	<i>Juniperus procera</i>	Cupressaceae	Yeabesha tid	T	Seeds	Flue	7	P
22	<i>Kalachoe petitiiana</i> A.Rich	Crassulaceae	Hanculullee	H	Leaves	Swelling	11	A
23	<i>Melia azedaracha</i>	Meliaceae	Niimi	T	Shoot tip	Malaria, toothache	98	P
24	<i>Millettia ferruginea</i> (Hochst.)Bak	Fabaceae	Hengedicho	Tree	Stem bark	Ecto- parasite	16	P
25	<i>Moringa stenopetala</i> L.	Moringaceae	Shifera	Tree	Leaves	Malaria, hypertension	23	P

Appendix III. Contd.

26	<i>Nicotiana tabacum</i> L.	Solanaceae	Araddo	Herb	Leaves	Common cold	14	A
27	<i>Olea europaea ssp.cuspidata</i>	Oleaceae	Ejersu	Tree	Stem	Tooth ache	19	P
28	<i>Ocimum lamiifolium</i>	Lamiaceae	Damakasse	Shrub	Leaves	Sun stroke	71	A
29	<i>Phytolacca dodecandra</i> L' Herit	Phytolaccaceae	Endod	Shrub	Root, leaves	Blahariza	5	P
30	<i>Podocarpus falcatus</i> (Thunb.)Mirb	Podocarpaceae	Zigiba	Tree	Stem bark	Jaundice	12	P
31	<i>Prunus africana</i> (Hook.F.)Kalkm.	Rosaceae	Garbicho	Tree	Bark	Cancer	6	P
32	<i>Rhamnus prinoides</i> L'Herit.	Rhamnaceae	Xaddo	Shrub	Leaves	Skin infection	11	P
33	<i>Rumex nepalensis</i> Spreng.	Polygonaceae	Sharbicho	Herb	Leaves/root	Ear problem, body Swelling	9	A
34	<i>Ruta chalepensis</i> L.	Rutaceae	Sunkurta	Herb	Leaves	Stomach problem	98	A
35	<i>Ricinus communis</i> L.	Euphorbiaceae	Qomboho	Tree	Root	Pneumonia	14	P
36	<i>Sesbania sesban</i> (L.) Merr.	Fabaceae	Arbeti	Shrub	Root	Body swelling	10	P
37	<i>Solanum incanum</i> L.	Solanaceae	Borbodho	Shrub	Root	Intestinal parasities	12	P
38	<i>Solanum nigrum</i> L.	Solanaceae	Xunaye	Herb	Leaves	Intestinal parasites	21	A
39	<i>Vernonia amygdalina</i> Del.	Asteraceae	Hecho	Tree	Leaves	Malaria	69	P
40	<i>Vernonia auriculifera</i> Hiern.	Asteraceae	Rejicho	Shrub	Leaves	Wound	9	P
41	<i>Withania somnifera</i> (L.)Dunal.	Solanaceae	Gizawa	Herb	Root	Pneumonia	39	P

Appendix IV. Timber (Furniture) tree species encountered in the study area.

No.	Scientific name	Local name	Family	Habit	Frequency	Duration
1	<i>Acacia albida</i>		Fabaceae	Tree	12	P
2	<i>Acacia melanoxylon</i> R.Br.	Omedlla(Amh)	Fabaceae	Tree	67	P
3	<i>Acacia tortilis</i> (Forssk.)	Teddecha	Fabaceae	Tree	14	P
4	<i>Albiza gummifera</i> (J.F.Gmel.	Matticho	Fabaceae	Tree	5	P
5	<i>Albizia schimperiana</i> var. <i>schimperiana</i>	Mukarba(Or)	Fabaceae	Tree	4	P
6	<i>Aningeria adolfi-friedericii</i>	Kararo	Sapotaceae	Tree	6	P
7	<i>Arundo donax</i>	Shenbeko	Poaceae	Shrub	9	P
8	<i>Azadirachta indica</i>	Neem	Meliaceae	Tree	3	P
9	<i>Casuarina equisetifolia</i> L.	Shewshewe	Casuarinaceae	Tree	87	P
10	<i>Celtis africana</i> Burm.f	Xoqono(Shisho)	Ulmaceae	Tree	8	P
11	<i>Cordia africana</i> Lam.	Wadicho	Boraginaceae	Tree	97	P
12	<i>Croton macrostachyus</i> Del.	Masicho	Euphorbiaceae	Tree	33	P
13	<i>Cupressus lusitanica</i> Mill.	Homme	Cupresaceae	Tree	98	P
14	<i>Eucalyptus camaldulensis</i> Dehn.	Duumo bahirzafe	Myrtaceae	Tree	29	P
15	<i>Eucalyptus globulus</i>	Waajoo bahirzafe	Myrtaceae	Tree	4	P
16	<i>Eucalyptus saligna</i> Smith.	Duumo bahirzafe	Myrtaceae	Tree	54	P

Appendix IV. Contd.

17	<i>Ficus sur</i> Forssk.	Odakko	Moraceae	Tree	8	P
18	<i>Ficus vasta</i>		Moraceae	Tree	14	P
19	<i>Grevillea robusta</i> R.Br.	Temenjzaf	Proteaceae	Tree	99	P
20	<i>Hagenia abyssinica</i> (Bruce)J.F.Gmel.	Dadako	Rosaceae	Tree	6	P
21	<i>Juniperus procera</i> HochstexEngl.	Honcho	Cupresaceae	Tree	13	P
22	<i>Melia azedarach</i> L.	Neem,	Meliaceae	Tree	118	P
23	<i>Olea europaea</i> L.ssp. <i>Cuspidata</i> (Wall.ex G.Don) Cif.	Ejersu	Oleaceae	Tree	7	P
24	<i>Pinus patula</i> L.	Patula	Pinaceae	Tree	16	P
25	<i>Pinus radiata</i>		Pinaceae	Tree	5	P
26	<i>Podocarpus falcatus</i> (Thunb.) Mirb.	Dagucho	Podocarpaceae	Tree	11	P
27	<i>Prunus africana</i> (Hook.f.)Kalkm	Garbicho	Rosaceae	Tree	9	P
28	<i>Syzygium guineense</i> (Wild.)DC.	Duwancho	Myrtaceae	Tree	3	P
29	<i>Balanites aegyptiaca</i> (L.) Del.	Badana	Balanitaceae	Tree	4	P

Appendix V. List of plants used as fire wood.

No.	Scientific name	Local name	Family	Habit	Fr.	Duration
1	<i>Acacia abyssinica</i> Hochst.Ex Benth	Wacho	Fabaceae	Tree	12	P
2	<i>Acacia albida</i>	Grar	Fabaceae	Tree	24	P
3	<i>Acacia etbaica</i> Schweinf.	Grar	Fabaceae	Tree	10	P
4	<i>Acacia mearnsii</i> DeWild.	Yefereji grar	Fabaceae	Tree	32	P
5	<i>Acacia nilotica</i>	Cheba	Fabaceae	Tree	6	P
6	<i>Acacia seyal</i> Del.	Wachu	Fabaceae	Tree	15	P
7	<i>Acacia melanoxylon</i> R.Br.	Omedella	Fabaceae	Tree	55	P
8	<i>Acacia tortilis</i> (Forssk.)Hayne	Deweni grar	Fabaceae	Tree	20	P
9	<i>Albiza gummifera</i> (J.F.Gmel.	Maxicho	Fabaceae	Tree	4	P
10	<i>Albizia schimperiana</i> var. <i>schimperiana</i>	Gorbe	Fabaceae	Tree	3	P
11	<i>Azadirachta indica</i>	Neem	Meliaceae	Tree	2	P
12	<i>Senna didymobotrya</i> (Fresen.) Irwin & Barneby	Hamashaqa	Caesalpinioideae	Shrub	4	P
13	<i>Casuarina equisetifolia</i> L.	Arezelibanos	Casuarinaceae	Tree	77	P
14	<i>Celtis africana</i> Burm.f	Amalaka	Ulmaceae	Tree	4	P
15	<i>Combretum collinum</i> Fresen.		Combretaceae	Tree	5	P
16	<i>Cordia africana</i> Lam.	Wanza	Boraginaceae	Tree	114	P
17	<i>Croton macrostachyus</i> Del.	Masincho	Euphorbiaceae	Tree	68	P
18	<i>Cupressus lusitanica</i> Mill.	Homme	Cupresaceae	Tree	76	P
19	<i>Dodonaea angustifolia</i> L.	Etancha	Sapindaceae	Tree	7	P
20	<i>Eucalyptus camaldulensis</i> Dehn.	Duumbahirzafe	Myrtaceae	Tree	78	P

Appendix V. Contd.

21	<i>Eucalyptus globulus</i>	Duume bahirzafe	Myrtaceae	Tree	2	P
22	<i>Ficus sur</i> Forssk.	Odakko	Moraceae	Tree	7	P
23	<i>Grevillea robusta</i> R.Br.	Temenjzaf	Proteaceae	Tree	89	P
24	<i>Hagenia abyssinica</i> (Bruce)J.F.Gmel.	Dadako	Rosaceae	Tree	12	P
25	<i>Jacaranda mimosifolia</i> D.Don.	Jacaranda	Bignoniaceae	Tree	79	P
26	<i>Justicia schimperiana</i> (Hochst ex.Nees	Cikkicho	Acanthaceae	Shrub	23	P
27	<i>Maytenus arbutifolia</i> (A.Rich.)Wilczek	Cucco	Cleastraceae	Tree	5	P
28	<i>Melia azedarch</i> L.	Neem,	Meliaceae	Tree	116	P
29	<i>Millettia ferruginea</i> (Hochst.)Bak.	Hengedicho	Fabaceae	Tree	10	P
30	<i>Olea europaea</i> L.ssp. <i>Cuspidata</i> (Wall.ex G.Don) Cif.	Ejersu	Oleaceae	Tree	19	P
31	<i>Pinus patula</i> L.	Patula	Pinaceae	Tree	36	P
32	<i>Podocarpus falcatus</i> (Thunb.) Mirb.	Dagucho	Podocarpaceae	Tree	24	P
33	<i>Prunus africana</i> (Hook.f.)Kalkm	Garbicho	Rosaceae	Tree	18	P
34	<i>Schinus molle</i> L.	Kunde berbere	Anacardiaceae	Tree	63	P
35	<i>Sesbania sesban</i> (L.) Merr.	Arbeti	Fabaceae	Shrub	39	P
36	<i>Spathodea campanulata</i> P.Beauv. ssp. <i>nilotica</i> .	Spathoda	Bignoniaceae	Tree	45	P
37	<i>Syzygium guineense</i> (Wild.)DC.	Duwancho	Myrtaceae	Tree	5	P
38	<i>Vernonia amygdalina</i> Del.	Hecho	Asteraceae	Shrub	74	P
39	<i>Balanites aegyptiaca</i> (L.) Del.	Badano	Balanitaceae	Tree	12	P

Cl, climbers; P, Perennial; A, Annual; C, Cultivated; W, Wild; T, Tree; Sh, Shrub; H, Herb.