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THE DIVERSITY OF FOOD AND MEDICINAL PLANTS IN THE HOMEGARDENS OF SABATA TOWN, OROMIA NATIONAL REGIONAL STATE, ETHIOPIA

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ABSTRACT: An ethnobotanical study of homegardens, focusing on food and medicinal plants, was undertaken in the peri-urban town of Sabata in Southwest Shewa Zone, Oromia National Regional State of Ethiopia. An initial inspection of 240 randomly identified houses in six study sites was made to check for presence of homegardens. Owners of 51 of the 186 houses with homegardens participated in free listing of the useful plants while preferentially selected 24 well-managed homegardens were taken up for detailed studies. Plant taxa used as food and medicine by owners were collected, taxonomically determined and analyzed. Ethnobotanical data were collected using semi-structured interviews employing preference ranking and paired comparison exercises. The data were then analyzed by employing descriptive statistics, Shannon-Wiener diversity Index, Sørensen's Similarity Coefficient and Clustering technique. About 78% of the houses inspected had homegardens, and food and medicinal plants accounted for 58 (43%) of the total 135 plant species recorded. The food plants constituted 37 species in 29 genera and 22 families with an average Shannon diversity Index of 2.04, while the medicinals were counted as 24 species in 22 genera and 17 families with an average Shannon Index of 1.83. *Allium sativum*, *Ensete ventricosum* and *Punica granatum* belong to nutraceutical plants or functional foods since they are listed both as food and medicinal. Comparison of Sabata homegardens with those of Walayita, Arbaminch and Bonga gave Sørensen's Similarity Coefficient of 37, 34 and 30%, respectively. The results provide strong reason for advocating maintenance of homegardens in Sabata and beyond. Further enhancement of the practice is in order in view of the contributions of the system to food provision and security, and ensuring nutritional quality, healthcare, biodiversity conservation, environmental quality and poverty reduction.

Key words/phrases: Agrobiodiversity, Food plants, Food security, Functional foods/nutraceuticals, Homegardens, Medicinal plants.

INTRODUCTION

The progress of prehistoric humans began from gradual utilization of their surroundings and cultivation of food and medicinal plants in the ancient homegardens (Maheshwari, 1988). Life that started with the collection of

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useful plants and animals gradually went onto the stage of small-scale plant and animal husbandry. The continued intensification of such practices resulted in the emergence of full-scale agriculture (Zemede Asfaw and Ayele Negatu, 1995). One of such traditional farming systems is the homegarden believed to have been part of human subsistence strategies since the Neolithic period (Soleri and Cleveland, 1989). Homegardens played important roles in the process of early plant domestication and continue to be avenues for introduction and adaptation of new crops (Brownrigg, 1985). These are traditional polycultural plots designated as mixed gardens, house gardens, compound farms, kitchen gardens, dooryard gardens and homestead agroforestry. Generally, they refer to the land surrounding a house where a mixture of annual and perennial plants is grown. Homegardening is practiced with or without animals being largely managed by household members for home use or commercial purposes (Godbole, 1998). Homegardens have initially developed independently in different parts of the world (Brownrigg, 1985; Landauer and Brazil, 1990). They were further shaped by knowledge transfer that strengthened their management and composition. In the tropics, homegardens are distinguished based on their contribution to the benefit of households (Marten and Abdoellah, 1988). In Ethiopia, their definition depends on various factors including land availability, agroclimatic conditions, accessibility to markets and peoples' livelihood systems, among others.

In most tropical countries, the major role of homegardens is continuous production of food throughout the year (FAO, 2004). Most of this production is for home consumption (Christanty, 1990; FAO, 2004). The potential benefit obtained from integrating homegardens into smallholder farming system encompass enhanced food security, income and improved rural employment through additional off-season production, risk aversion and nutritional improvement. Homegardens also foster food diversity, alleviate seasonal food scarcity and confer environmental gains through recycling water and wastes, provision of shade, dust and erosion control and maintaining and enhancing local biodiversity (FAO, 2004).

The limited studies available on Ethiopian homegardens fall under two categories. The first category include some general studies made by Zemede Asfaw and Ayele Nigatu (1995) and Zemede Asfaw (1997, 2001a and 2001b) and the second involves detailed studies in Walayita and Guragie (Zemede Asfaw and Zerihun Woldu, 1997), Bonga (Feleke Woldeyes, 2000), Arbaminch area (Belachew Wassihun *et al.*, 2003), Sidama (Tesfaye Abebe, 2005) and Walayita (Talemos Seta, 2007). Other studies dealt with

part of general studies on farming systems and agrobiodiversity (Altieri, 1995). The homegardens of Sabata, a peri-urban town located at about 24 km southwest of Addis Ababa, have not been studied in such detail. In the present study, an attempt was made to investigate the significance of this traditional farming system in sustaining food security through provision of diverse nutritional habits to the people of the study area. Concomitantly, an attempt was made to inquire systematically about the contributions of homegardens of the area in maintaining plant species with traditional medicinal importance for humans and for veterinary purposes.

MATERIALS AND METHODS

Description of the study area

This ethnobotanical study on food and medicinal plants was conducted between November 2007 and March 2008 in the homegardens of the peri-urban town of Sabata. This town is the capital of Sabata Awas District (formerly called Alamganaa District) in Southwest Shewa Zone, Oromia National Regional State of Ethiopia (Fig. 1). The area is located within the geographic co-ordinates of $08^0$54.649' N to $08^0$58.137' N latitudes and $038^0$37.723' E to $038^0$40.579' E longitudes. It is situated at a distance of 24 km southwest of Addis Ababa between the altitudinal ranges of 2195 and 2300 m, a.s.l. (cf. Habtamu Hailu, 2008 and sources cited therein). The area lies within the tepid-humid mid highland (H_3) agroecological zone (MOA, 2002). The mean annual rainfall (1997- 2006 climate data) is 955 mm, the highest rainfall being recorded in July and the lowest in November. The mean maximum and minimum temperatures (1997 - 2006 climate data) are 22^0C and 10^0C, respectively. According to the Oromia Urban Planning Institute (OUPI), the geology of the study area is basically derived from Mesozoic sedimentary and volcanic rocks (OUPI, 2008). The same report showed that the major soil types are Chromic and Pellic Vertisols (76.1%) and Chromic and Orthic Luvisols (23.9%).

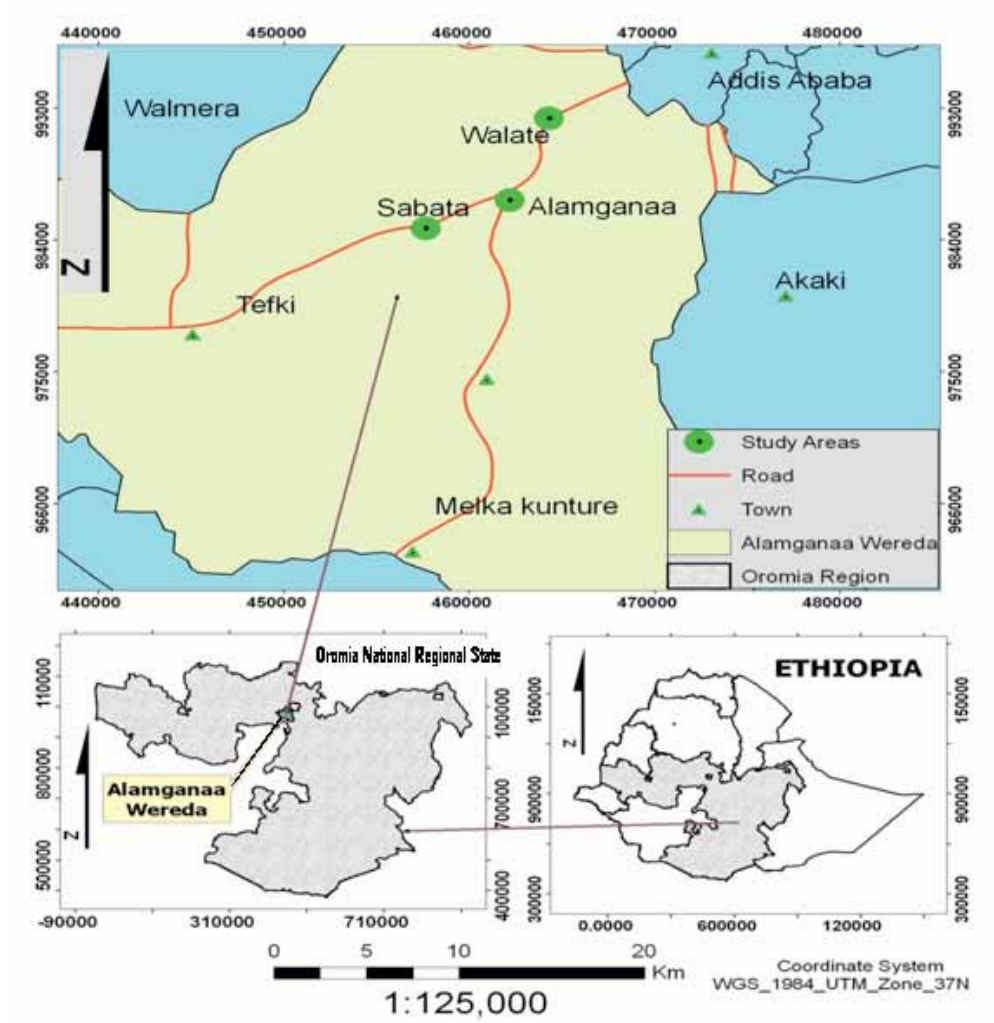

Fig. 1. Map of the study area (Source: Drawn from Ethio: GIS data)

The natural vegetation of the study area belongs to the afromontane forest type (Sebsebe Demissew and Friis, 2009). This is, however, only noticeable now from the limited remnant tree species like *Ficus* spp. and *Olea europaea* ssp. *cuspidata* left as shade trees, on fences and in some secluded areas. *Eucalyptus* trees occur on hilly areas, in open spaces and in homestead compounds as also reported by the OUPI (2008). Sparsely scattered vegetation of shrubs, bushes and riverine woody species are found along with planted trees and protected government and community forests.

This is observable in Sabata Awas District and also given in the report by the Regional Statistics and Information Center (RSIC, 2006). The current population of the town is 56,131 (49.64% male, 50.36% female). These belong to different ethnic groups including the Oromo, Amhara, Guragie, Silte, Tigrie, Walayita, Dorzie, Gamo, Goffa, Konta, Dawro and others (CSA, 1994, 2008). In this small town, such diverse ethnic groups live together in harmony with mix of cultural assets of practices and traditions for maintaining the diversity of food and medicinal plants.

Sampling techniques and data collection

An initial survey undertaken in the study area dealt with identification of six research sites in three "kebeles (the lowest local administrative level)" [Sabata-01, Sabata-02 (Alamganaa) and Sabata-03 (Walate)]. This was followed by inspection of randomly selected houses scoring 240 (80 houses in each kebele) for presence or absence of an associated garden. Fifty-one homegardens (seventeen from each kebele) were also preferentially selected for free listing of garden flora. Twenty-four best-managed homegardens (eight in each kebele, four of each from the northwestern and southeastern part of the Addis Ababa - Jima highway) were preferentially selected for detailed study. Permission of the owners of homegardens was secured after explaining the objective and the ethical use of the results only for academic purpose. Twenty-four quadrats (2400 m^2 or 0.24 ha) were sampled each 10 m x 10 m (100 m^2). Plant specimens from twenty-four of the sampled homegardens were collected, pressed, dried and frozen. Determination of plants was made using the modern Flora of Ethiopia and Eritrea and reconfirmed by comparing them with the authenticated specimens housed at the National Herbarium (ETH), Addis Ababa University (AAU).

Ethnobotanical techniques were employed to gather data following Martin (1995). The techniques were semi-structured interview, informant consensus, free listing, preference ranking, paired comparison and market survey. Free listing exercise by 51 homegarden owners helped to select species with high consensus values. Further tallying of the most frequent species was used as a basis for selection of ten most widely used food crops. Ten key informants participated in ranking these crops. The scores given to each species as per informant's preferences were added and ranked. Paired comparison was carried out for five most desirable vegetable crops of homegardens that have market utility. The selection of these vegetables was based on collective opinion of the informants and by undertaking market survey in the study area. The data were analyzed using descriptive statistical

methods, Shannon-Wiener Diversity Index (H'), Sørensen's Similarity Coefficient and Cluster Analysis. Shannon-Wiener Index (1949) was applied to quantify species diversity and richness for food and medicinal plants using the formula: $H' = \Sigma (Pi \ln Pi) / \ln Pi$. H' stands for the Shannon-Wiener Diversity Index, Pi is the ratio of a species average to the total species average and ln the natural logarism to base e ($\log_e e$). Similarity indices measure the degree to which the species composition of quadrats is alike. Sørensen's Coefficient was found suitable for assessing the similarity of plant species composition in quadrats of homegardens of Sabata town compared with some other studies previously conducted in the country (Feleke Woldeyes, 2000; Belachew Wassihun *et al*, 2003 and Talemos Seta, 2007). Coefficient of similarity (SS) is defined using the formula: $SS = 2a / 2a + b + c$, where SS = Sørensen's Similarity Coefficient, a = number of species common to quadrats, b = number of species in quadrat 1 and c = number of species in quadrat 2. The coefficient values range from 0 (complete dissimilarity) to 1 (total similarity) (Kent and Coker, 1992). Multivariate data analysis method (cluster analysis) was used to cluster the informants on their responses and check on the degree of homogeneity. Clustering algorithm was implemented by using PC-ORD Version 4.0 Statistical Software Package (McCune and Mefford, 1999).

RESULTS AND DISCUSSION

The diversity of food plant species in homegardens of Sabata town

This study recorded 135 plant species from the homegardens of Sabata town, a practice undertaken by about 78% (186) of households (cf. Habtamu Hailu, 2008 and sources cited therein) in the sample. The mean proportions of plant groups per garden were computed for the free listing data that were obtained from 51 homegarden owners of the study area. Accordingly, live fences indicated an average of 5.8 (17.3%) species, medicinal plants 4.56 (13.6%) and shade trees 4.36 (13%) which accounted for the first, second and third ranks, respectively. Utility plants constituted an average of 3.62 (10.82%), fruits 3.58 (10.7%), ornamentals 3.35 (10%), stimulants and fragrant plants constituted 3.04 (9.07%). Vegetables together with roots and tubers make up 3.62 (10.8%), while the other groups (pulses, sugars, fuelwoods and non-food spices) occurred in smaller proportions (Fig. 2). However, considering the proportion of food plant groups, fruits, vegetables, spices, roots/tubers and sugars came with the highest proportion of 23.85 % (7.98 species). This also indicates the primary utility function of homegardens under subsistence economies.

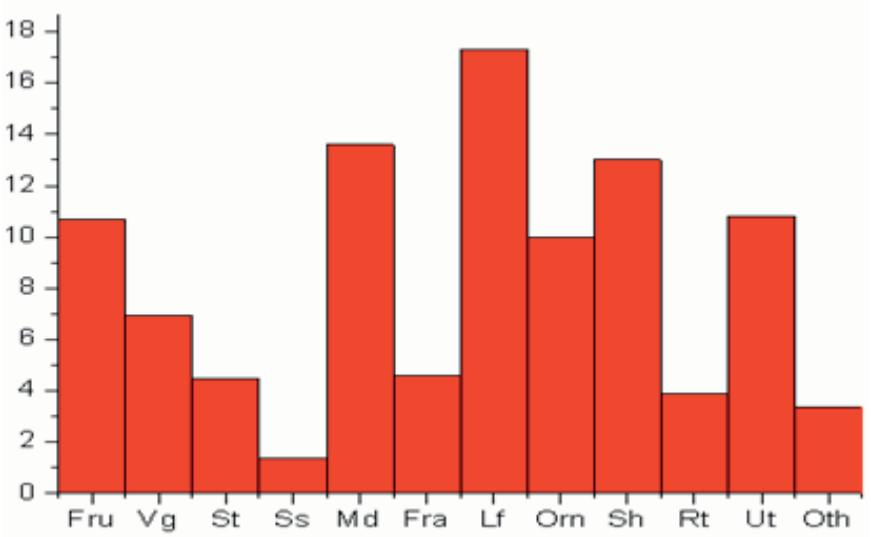

Fig. 2. Mean proportions of plant groups per garden which are obtained by the free listing data of 51 homegarden owners from the three kebeles of the study area. (Fru = Fruits, Vg = Vegetables, St = Stimulants, Ss = Spices, Md = Medicinal plants, Fra = Fragrant plants, Lf = Live fences, Orn = Ornamentals, Sh = Shade trees, Rt = Roots and tubers, Ut = Utility plants, Oth = Others).

On the other hand, the detailed study of 24 best-managed homegardens of Sabata town indicated 43% of the species in the categories of food and/or medicinal plants. The food plants category, which made 27.40% of the homegarden flora (cf. Habtamu Hailu, 2008), came as the highest single food plant group consisting of fruits, vegetables, spices, roots/tubers, sugars and pulses. The proportion within the food plants category of the three kebeles is given in Fig. 3 after grouping the data in Table 1. The cultivation of food plants is an important tradition of the people of the study area and this is recognized by homegardens with diverse species of food plants. The definition of homegardens and the general predominance of horticultural crops including fruits, nuts and vegetables highlighted by Christanty (1990), Okigbo (1990) and Godbole (1998) match well with the present finding.

Table 1. List of food plant species in Sabata town homegardens and plant parts used.

No.	Scientific name	Family name	Vernacular name	Habit	Part(s) consumed
	Fruit crops				
1	*Annona cherimola* Mill.	Annonaceae	Gishta (A)	Tree	Fruit
2	*Casimiroa edulis* La Llave▲	Rutaceae	Shasho (A)	Tree	Fruit
3	*Citrus aurantifolia* (Christm.) Swingle▲	Rutaceae	Lomii (O)	Shrub	Fruit
4	*Citrus aurantium* L.	Rutaceae	Komtatie (A)	Shrub	Fruit
5	*Citrus medica* L.	Rutaceae	Trngo (A)	Shrub	Fruit
6	*Citrus sinensis* (L.) Osb. ▲	Rutaceae	Burtukana (O)	Shrub	Fruit
7	*Malus sylvestris* Miller	Rosaceae	Pomii (O)	Tree	Fruit
8	*Mangifera indica* L. ▲	Anacardiaceae	Mango (O, A)	Tree	Fruit
9	*Morus alba* L.	Moraceae	Njorie (A)	Tree	Fruit
10	*Musa paradisiaca* L. ▲	Musaceae	Muzii (O)	Herb	Fruit
11	*Passiflora edulis* Sims	Passifloraceae	Yezenjero-Kolet (A)	Liana	Fruit
12	*Persea americana* Mill.	Lauraceae	Abukado (O, A)	Tree	Fruit
13	*Prunus x domestica* L.	Rosaceae	Prim (A)	Tree	Fruit
14	*Prunus persica* (L.) Batsch	Rosaceae	Koki (O)	Tree	Fruit
15	*Psidium guajava* L. ▲	Myrtaceae	Zeyitunnaa (O)	Tree	Fruit
16	*Punica granatum* L.*	Punicaceae	Romaana (O)	Shrub	Fruit
17	*Vitis vinifera* L.	Vitaceae	Weyn (A)	Liana	Fruit
	Vegetable crops				
18	*Allium cepa* L. ▲	Alliaceae	Qullubbii-diimaa (O)	Herb	Bulb, leaves
19	*Allium sativum* L.* ▲	Alliaceae	Quulubii-adii (O)	Herb	Bulb, leaves
20	*Beta vulgaris L.*	Chenopodiaceae	Qosta (A)	Herb	Leaves
21	*Brassica carinata* A. Br.	Brassicaceae	Yeguragie gomen(A)	Herb	Leaves
22	*Brassica oleracea* L.	Brassicaceae	Goommana (O)	Herb	Leaves
23	*Brassica oleracea* L. ▲	Brassicaceae	Tql-gomen (A)	Herb	Leaves
24	*Capsicum annuum* L. ▲	Solanaceae	Barbaree (O)	Herb	Leaves
25	*Cucurbita pepo* L. ▲	Cucurbitaceae	Dabaaqula (O)	Liana	Fruit
26	*Daucus carota* L.	Apiaceae	Kaarota (O)	Herb	Root
27	*Lactuca sativa* L.	Asteraceae	Selata (A)	Herb	Leaves
28	*Lycopersicon esculentum Mill.* ▲	Solanaceae	Timatimi (O)	Herb	Fruit
	Root/tuber				
29	*Colocasia esculenta (L.) Schott*	Araceae	Godaaree (O)	Herb	Tuber
30	*Ensete ventricosum (Welw.) Cheesman.**	Musaceae	Kocho (A)	Herb	Stem, corm
31	*Solanum tuberosum L.* ▲	Solanaceae	Dinichaa (O)	Herb	Tuber
	Pulses				
32	*Phaseolus lunatus L.*	Fabaceae	Adengwarrie (A)	Liana	Seed
33	*Phaseolus vulgaris L.*	Fabaceae	Boloqqie (A)	Liana	Seed
34	*Vica faba L.*	Fabaceae	Baqiela (A)	Herb	Seed
	Spices				
35	*Lepidium sativum L.* * ▲	Brassicaceae	Feechoo (O)	Herb	Seed
36	*Ocimum basilicum L. var. basilicum* ▲	Lamiaceae	Besobilla (A)	Herb	Leaves, flowers
	Sugar crops				
37	*Saccharum officinarum L.*	Poaceae	Shenkor-ageda (A)	Herb	Stem

▲ Homegarden products found in the market during the market survey in March 2008

* also medicinal; (O) = Vernacular name in Afaan Oromo, (A) = Vernacular name in Amharic

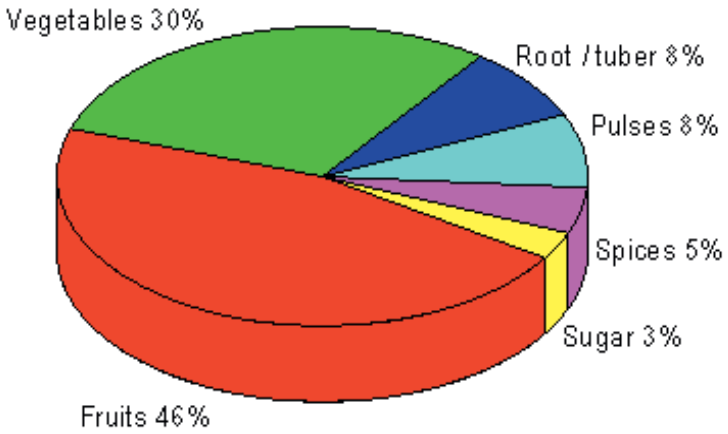

Fig. 3. Categories of food plants and their proportions in Sabata town homegardens

The role of homegardens in improving family livelihoods: food Security, nutrition and income

The cultivated homegarden plants are composed of species used for food and for other purposes. Thirty-seven species that are distributed among 29 genera and 22 families were documented as food plants in the present study (Table 1). These accounted for 27.40% of the total species maintained in homegardens. Among these, 45.95% of the species were fruit crops and 29.73% were vegetables. Pulses together with spices constituted 13.51% and root/tuber and sugar crops comprised 10.81%. Three species (12.5 %) including garlic, enset and pomegranate are further regrouped as nutraceuticals or functional foods following the definition of Basu *et al.* (2007). Since functional foods are generally defined as being similar in appearance to conventional foods and consumed as part of a usual diet, these plants can best be considered as functional foods. Nutraceuticals tend to be generally understood as products made from foods but sold in the form of pills, powders and other medicinal forms. Whereas a functional food is essentially taken like any food, some authors consider nutraceuticals to be forms of food prepared from food plants to function as medicine (Bull *et al.,* 2000). Homegardens are known to produce a considerable number of plants that are utilized as nutraceuticals and functional foods, which offer health

benefits in addition to the usual dietary roles.

The largest number of the food crops goes to herbs (48.65%), and fruits are the most usable parts (54.05%). Family Rutaceae is represented by 5 species, Brassicaceae by 4 species, Rosaceae, Fabaceae and Solanaceae by 3 species each. The Alliaceae and Musaceae are represented by 2 species each and all the rest by a single species (Table 1). The highest Shannon-Wiener Diversity Index (H') was attained for food plants at W_5 site (2.49) and the least at S_1 site (1.79) (Table 2). Diversity indices reported from homegarden studies range between 1.12 and 3.00 for India (Kumar *et al*., 1994) and 1.90 to 2.70 for Thailand (Gajaseni and Gajaseni, 1999). The present results fall within the ranges obtained in other areas.

Table 2. Shannon-Wiener Diversity Index (H') for food plants in the six research sites

Research sites	Food plants	
	Species richness	Shannon's index (H')
S_1	14	1.79
S_2	21	1.83
A_3	15	1.79
A_4	21	2.2
W_5	21	2.49
W_6	20	2.12
Average	19	2.04

Note: S_1 andS_2 are study sites in Kebele 01, A_3 and A_4 in Kebele 02 and W_5 and $W_{6\ in}$ Kebele 03

The highest floristic similarity index was indicated in the homegardens of Walayita (0.37) relative to Sabata town. Bonga homegardens, on the other hand showed the weakest similarity coefficient of 0.30 (Table 3). Accordingly, there is 37, 36 and 34% similarity in food and medicinal plants composition between the homegardens of Sabata on the one hand and those of Walayita, Arbaminch and Bonga on the other.

Table 3. Sørensen's similarity coefficient for food and medicinal plant species composition in the homegardens of Sabata town with Walayita, Bonga and Arbaminch

Place	Number of species found	Common species	Sørensen's Coefficient	Percentage Similarity
Walayita	76	40	0.37	37
Bonga	82	30	0.30	30
Arbaminch	66	32	0.34	34
Sabata Town	58	-	-	-

The diverse food crops of homegardens of Sabata have relevant significance to increase household food production and to improve the nutritional status of low income households. It is reported that high prevalence of Protein Calorie Malnutrition (PCM) occurs in the area. Oedema (Kwashiorkor), Wasting (Marasmus), iron and vitamin A deficiencies are the most frequently recurring problems of malnutrition for children under age five at present (Per.comm. with health professionals at Sabata Health Centre). They further indicated that growth monitoring and promotion chart/scale dropped below 60% of the body weights of such children, signifying severe malnutrition. They recall that severe undernourished cases, often reported from Sabata kebele 03 (Walate) might be linked to households without homegardens and those who could not afford the required food items. It might as well be linked to lack of awareness of the nutritional security values of homegardens. The situation may be likened to the wide prevalence of undernourished children shown by a study conducted in the homegardens that specialize in tea plantation in West Java (Husaini *et al*., 1990). In that study, Husaini *et al*. (1990) showed that families with well established homegardens had significant improvement on their income and food security status.

Homegardens of the study area embrace a genuine portion of agrobiodiversity which represent a supplementary source of food and a privileged basis for nutritional quality. A study by FAO (2004) showed that homegardens are helpful to cope with food shortage periods and failures of staple crops. Homegardens have an established tradition and offer great potential for improving household food security and in alleviating micronutrient deficiencies. They enhance food security in several ways, most importantly through direct access to a diversity of nutritionally rich foods (FAO, 2001). The same report further showed that homegardens confer increased purchasing power from savings on food and income from sales of garden products, and act as a fallback food provision during seasonal lean periods.

Our analysis showed that *Persea americana* came in the first rank and *Prunus domestica* in the lowest rank of most frequent species, as given in Table 4. *Persea americana* is the most favoured food crop, which could partly relate to its income generating role, and *Prunus x domestica* the least for people of the study area. A relatively high degree of similarity between the responses of informants regarding the widely used food plants was obtained (Fig. 4). The general consensus on roles of widely used food crops was evident.

Table 4. Simple preference ranking for widely used food crops of homegardens: 10- most valuable, 1- least valuable.

Species name	Scores given by Key Informants / Respondents (R)											
	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}	Total score	Rank
Casimiroa edulis	4	1	6	1	6	7	4	1	2	7	39	8
Citrus sinensis	10	7	5	8	5	10	9	5	6	9	74	2
Ensete ventricosum	1	6	10	7	1	4	5	10	10	10	64	3
Malus sylvstris	6	2	7	10	10	6	10	3	4	2	60	5
Mangifera indica	2	9	8	5	8	9	8	4	3	6	62	4
Musa paradisiaca	7	10	1	3	4	8	6	9	5	3	56	6
Persea americana	5	8	9	9	9	5	7	8	9	8	77	1
Prunus x domestica	8	5	2	6	7	1	1	2	1	1	34	10
Psidium guajava	3	4	3	2	3	2	2	6	7	5	37	9
Saccharum officinarum	9	3	4	4	2	3	3	7	8	4	47	7

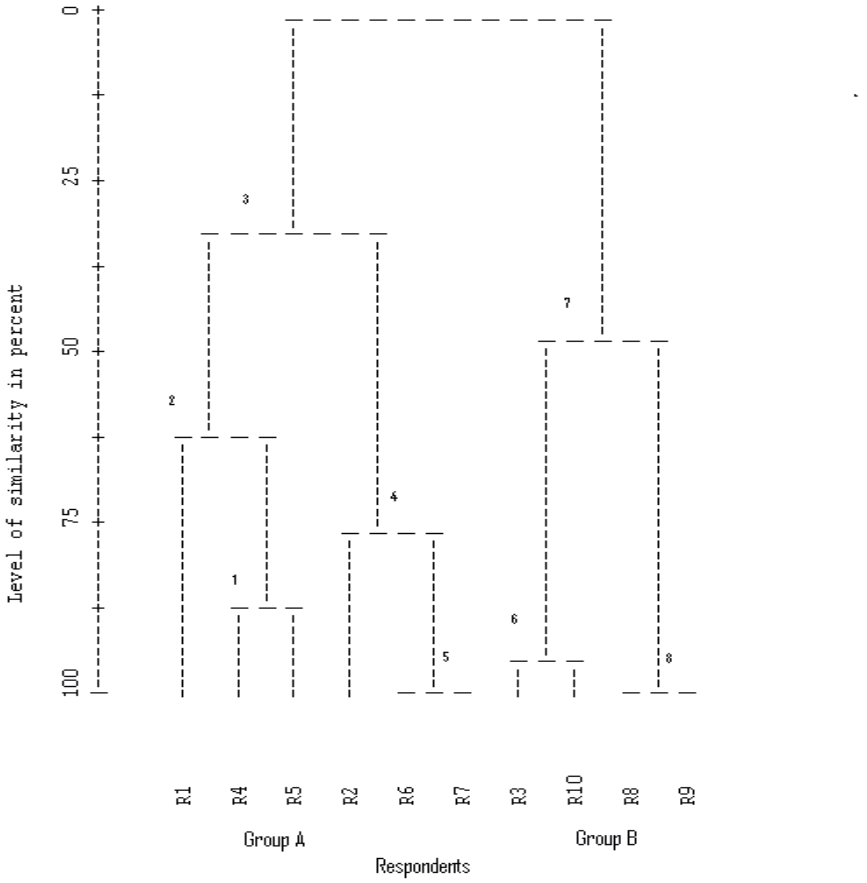

Fig. 4. Dendrogram showing the similarity of responses concerning the widely used food plants.

Homegarden plant species of Sabata with medicinal uses

From the total plant species (135) recorded in this study (cf. Habtamu Hailu, 2008) about 24 species (17.77%) belonging to 22 genera and 17 families serve the community as traditional medicinal plants. Species of the families of Asteraceae and Lamiaceae were the most used and each accounted for 16.6% of the total medicinal plants. The bulk of the medicinally used plants constituted about 54.16% herbs and 29.16% shrubs with leaves accounting for 75% of the plant parts used. The computation of data on medicinal plants by employing Shannon-Wiener Diversity Index showed that site W_6 is the most diversified one attaining a diversity index of 2.05. Site A_4 is less diversified (1.80) next to site S_2 (1.53) (Table 5). Mohan (2004) calculated Shannon-Wiener indices ranging from 1.15 to 1.42 for annual, perennial and medicinal species in Indian homegardens.

Table 5. Shannon-Wiener Diversity Index (H') for medicinal plants in the six research sites

Research sites	Medicinal plants	
	Species Richness	Shannon's index (H')
S_1	17	1.83
S_2	12	1.53
A_3	10	1.87
A_4	14	1.8
W_5	16	1.9
W_6	14	2.05
Average	14	1.83

Note: S_1 and S_2 are study sites in Kebele 01, A_3 and A_4 in Kebele 02 and W_5 and $W_{6\ in}$ Kebele 03

The common traditional medicinal plants utilized by people of the study area are given in Table 6 along with health problems treated, method of preparation and application. These medicinal plants are believed to be good remedies for various ailments. These encompass dermatological, gastro-intestinal, neurotic, respiratory impairments of the body functions, spiritual satisfaction and veterinary ailments. Fifteen (62.5%) of the medicinal plants are used by the local people to treat abdominal pain including intestinal parasites. The therapeutic benefits of these traditional medicines are mentioned by Amare Getahun (1976), Jansen (1981), Zemede Asfaw and Ayele Nigatu (1995), Belachew Wassihun *et al*. (2003), Dawit Abebe *et al*. (2003) and Talemos Seta (2007).

Table 6. Plant species found in Sabata homegardens with medicinal uses

No.	Species name	Family name	Vernacular name	Habit	Part used	Health problems treated	Method of preparation and application
1	*Ajuga integrifolia* Buch.-Ham. ex D. Don	Lamiaceae	Armaguussa	Herb	Leaf	Lack of appetite, Abdominal pain	Leaf extract is taken with water for stomach complaint
2	*Allium sativum* L.[Nc] ▲	Alliaceae	Qullubbii-adii	Herb	Bulb	Flue, Malaria, Headache, Abdominal pain	Bulb is eaten (raw or boiled)
3	*Artemisia absinthium* L. ▲	Asteraceae	Arritti	Herb	Leaf	Evil-eye	Fragrant leaves are used to be protected from the evil eye
4	*Artemisia afra* Jacq. ex Willd.▲	Asteraceae	Jukunn	Herb	Leaf	Evil-eye	Fragrant leaves are used to be protected from the evil spirit
						Abdominal pain	Leaf extract is used to treat stomach disorder in children
5	*Calpurnia aurea* (Ait.) Benth.	Fabaceae	Ceekaa	Shrub	Root	Hemorrhoid	Roots are pounded, mixed with water and taken orally to cure hemorrhoid
					Seed	Veterinary diseases	Seeds are crushed, mixed with food and are given to rabid dogs
6	*Commelina* sp.	Commelinaceae	Hoolaagabbis	Herb	Stem sap	Ring worm (Tinea corporis)	The sap extracted from the stem is rubbed on the infected skin
					Stem	Amoebiasis	The stem is chewed to relieve ameobiasis
7	*Croton macrostachyus* Del.	Euphorbiaceae	Bakkannissa	Tree	Leaf sap	Ring worm (Tinea corporis)	Sap extracted from the leaf is rubbed on the infected skin
8	*Cymbopogon citratus* (Dc.) Stapf	Poaceae	Tejsar*	Herb	Root	Abdominal pain	Root chewed to treat abdominal colic
					Leaf	Evil-spirit	Fragrance of leaves is used to safeguard from the evil spirit

Continued from Table 6

No.	Species name	Family name	Vernacular name	Habit	Part used	Health problems treated	Method of preparation and application
9	*Datura stramonium* L.	Solanaceae	Asangira	Herb	Leaf	Wounded scalp	Leaf is squeezed and the extract smeared on the wounded scalp especially in children
10	*Ensete ventricosum* (Welw.) Cheesman. [Nc]	Musaceae	Kocho-dimma /Warqee	Herb	Corm	Broken limbs	Underground corm boiled and eaten to recover from injured limbs
					Leaf	Expel after birth (placenta) in cattle	Juice of the plant is employed
11	*Eucalyptus globulus Labill.*	Myrtaceae	Baargamoo-adii	Tree	Leaf	Flue, Cough	The leaf is boiled and the steam is inhaled
12	*Foeniculum vulgare* Mill.	Apiaceae	Insilaalaa	Herb	Leaf	Abdominal pain, Hypertension	The leaves boiled with tea or coffee is drunk for stomach complaint and hypertension
						Flue, Evil-eye	The fragrant leaves are used against flue and the evil-eye
13	*Hagenia abyssinica* (Bruce) J. F. Gmel.	Rosaceae	Heexoo	Tree	Flower	Tape worm Expellant	Dried and pounded female inflorescence (flower) is mixed with water and taken orally as a taenicide against Taenia saginata
14	*Juniperus procera* Hochst. ex Endl.	Cupresaceae	Gaattiraa	Tree	Leaf	Flue	The leaves are boiled together with *Eucalyptus globulus* and *Ocimum lamiifolium*, and the steam is inhaled
15	*Justicia schimperiana* (Hochst. ex Nees) T. Anders.	Acanthaceae	Dhummuugaa	Shrub	Leaf	Skin rash	The body is washed with boiled leaves to treat skin rash
					Root	Sexually Transmitted Diseases (STDs), Jaundice	The root is ground, mixed with water and is drunk to treat venereal diseases and jaundice
16	*Lepidium sativum* L.	Brassicaceae	Feechoo	Herb	Seed	Constipation and Diarrhoea	The seeds are ground, mixed with lemon and water and are taken orally to cure constipation and diarrhoea
						Skin rash	The seeds are ground, mixed with lemon and water and rubbed on the skin to treat skin rash

Continued from Table 6

No.	Species name	Family name	Vernacular name	Habit	Part used	Health problems treated	Method of preparation and application
17	*Mentha spicata* L.	Lamiaceae	Nana*	Herb	Leaf	Constipation, Hemorrhoids, Difficulty in urination	The leaves are boiled with tea and are taken orally
18	*Ocimum lamiifolium* Hochst. ex Benth.	Lamiaceae	Qoricha-michii / Yeqen damakese*	Shrub	Leaf	Headache	The infusion of leaf is snuffed and used as analgesic agent
						Abdominal pain	The extracted fluid is taken orally with coffee and used as amoebicide agent
19	*Ocimum urticifolium* Roth	Lamiaceae	Qoricha- michii (Anchabbii) / Yelelit damakese*	Shrub	Leaf	Abdominal pain	The leaves are squeezed and the fluid is taken orally with coffee to recover from abdominal pain
						Evil-spirit	The leaves are squeezed and the fluid is rubbed on the skin as protection from evil spirits
20	*Punica granatum* L.[Nc]	Punicaceae	Romaana	Shrub	Leaf	Expel tape worm	Decoction of the leaf is used to expel tape worm
21	*Ruta chalepensis* L. ▲	Rutaceae	Ciraakkota / Chilatamaa	Shrub	Leaf	Abdominal pain	Leaf extract is taken orally or the leaves are chewed to heal abdominal pain
						Evil eye, Evil-spirit	The fragrance of leaves are also used as protection from evil-eyes/evil-spirits
22	*Vernonia amygdalina* Del.	Asteraceae	Eebicha	Shrub	Leaf	Abdominal pain, Intestinal parasites, Veterinary diseases	Leaf extract (fluid) is taken orally
23	*Withania somnifera* (L.) Dunal in Dc.▲	Solanaceae	Gizawa*	Herb	Leaf	Abdominal pain	Leaf extract (fluid) is taken orally
24	*Xanthium strumarium* L.	Asteraceae	Deha-nikel*	Herb	Leaf	Cutaneous candidiasis	The inflicted skin is rubbed with the leaves

Note: [Nc] = Nutraceutical plants; Vernacular names are in Afaan Oromo, and Amharic when indicated (*) ▲= Homegarden products found in the market during the market survey in March 2008

Impacts of market forces on Homegarden agrobiodiversity

There are two market centres in Sabata town (Sabata Gebeya in Sabata Kebele 01 and Alamganaa Gebeya in Sabata Kebele 02) where plant products and germplasm are marketed. There is no market centre in Sabata Kebele 03/Walate. Producers of this kebele mostly sell their garden produces in Addis Ababa on account of its proximity and better price fetching opportunity of the products. Plant products of homegardens of the area and field crops of the immediate vicinity are exchanged in these markets. Most sellers of garden products asserted that most of the garden products they sell have been harvested from their homegardens. During a market survey in Sabata town, 6 fruits, 6 vegetables, 2 spices, 1 tuber and 5 medicinal plant species were recorded among others (Tables 1 and 6). Since homegarden products are available at different times of the year more species are also marketed during their harvesting seasons, though not encountered during the survey in March 2008. Generally, the abundance and diversity of these plant products on the market and at home decrease during the dry season and increase in the rainy season especially for the herbaceous ones. Moreover, some homegarden owners of the study area reported that, on the average, about 5 quintals of potato, 6 quintals of carrot, 50 bundles of Ethiopian kale, 50 kg of tomato and 1000 heads of cabbage were estimated to be produced per garden per growing season. Pair wise comparisons, using ten key informants on five most desirable food crops of homegardens with market utility gave potato (*Solanum tuberosum*) in the first rank with a score of 30, Ethiopian kale (*Brassica carinata*) with a score of 22 and cabbage (*Brassica oleracea*) with 19 in the second and third places, respectively (Table 7).

Table 7. Results of pair wise comparison of five homegarden food crops with market utility by ten key informants.

Food crop	Total score	Rank
Carrot (*Daucus carota*)	12	5
Cabbage(*Brassica oleracea*)	19	3
Ethiopian Kale (*Brassica carinata*)	22	2
Potato (*Solanum tuberosum*)	30	1
Tomato (*Lycopersicon esculentum*)	18	4

In addition to nutritional benefits (diet diversification/improving micronutrient intake), homegardens of the study area have considerable contribution in generating income for the family. The income enables families to afford other staples and food items that they do not produce in their gardens. However, it is observed that there is a general tendency or

inclination towards the production of few income generating food crops (vegetables) in Sabata town. This market-driven agricultural activity resulted in bulk production of few crops and reduced agrobiodiversity to some degree. It also forces diversity to concentrate more in non-irrigated parts (northwest) of kebele 03. In irrigated parts, they mostly concentrate on a near monoculture of few highly marketed crops like potato and cabbage. The production of food crops in the homegardens is known to improve the status of food security and enhance the quality of nutrition for people of the area. However, it should be done without devastating biodiversity, which is the natural wealth of the present and future generation of the locality in particular, and of the country in general. The present study revealed that tuber crops like potato (*Solanum tuberosum*) and vegetables like carrot (*Daucus carota*), Ethiopian kale (*Brassica carinata*), cabbage (*Brassica oleracea*) and tomato (*Lycopersicon esculentum*) were among the widely cultivated food crops of homegardens of the area. They also have high market forces with good monetary returns to the households. Currently, investment activities are also progressing in the area. This could have negative impacts on the future fate of homegardening and agrobiodiversity conservation unless households and the local government timely take the necessary precautionary measures. According to Altieri (1995), in agricultural systems, the role of biodiversity goes beyond the production of food, fibre, fuel provision and income optimization. It provides essential ecosystem services through recycling of nutrients, control of local microclimate, regulation of local hydrological processes, and detoxification of obnoxious chemicals. It is time that Sabata homegardens start being seen from the latter angles as well.

CONCLUSION

Homegardens of the study area embody a genuine portion of agrobiodiversity, which represent a supplementary source of food and a privileged basis for nutritional quality. Other than their nutritional values, the homegardens of the study area provide significant contribution in ecosystem services and in generating income for the family. The income enables families to afford other staple crops that are not cultivated in their gardens. They can improve the status of food security and nutritional quality. Further enhancement and proper management would help realization of the high potentials of the homegardens of Sabata town. They can also be good models for the local communities in other peri-urban towns in the vicinity of Addis Ababa to follow the Sabata strategy to upgrade their livelihoods. The general tendency towards the production of few lucrative

food crops in Sabata town is pushing market-driven gardening activity. This leads to bulk production of a few crops and reduced agrobiodiversity to some degree or forces diversity to be restricted to the non-irrigated parts of the town. Such activities have to be carried out paying attention to optimum balance without negatively affecting the biota, which is the natural wealth for the present and future generation of the locality.

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